OCCUPATIONAL ANALYSES SERIES

Refrigeration and Air Conditioning Mechanic

1997

Human Resources
Development Canada

Développement des
ressources humaines Canada

Canada

LM-446-07-97E

103-04338/

Occupational Analyses Series

Refrigeration and Air Conditioning Mechanic

1997

Standards, Planning
and Analysis

Normes, planification
et analyse

Human Resources
Partnerships Directorate

Direction des partenariats
en ressources humaines

Disponible en français sous le titre : Mécanicien/mécanicienne de réfrigération et d'air climatisé

©Minister of Public Works and Government Services Canada 1997
Cat. No. MP32-11/16-1997E
ISBN: 0-662-25937-8

The Canadian Council of Directors of Apprenticeship (CCDA) recognizes this occupational analysis as the national standard for the occupation of refrigeration and air conditioning mechanic.

ACKNOWLEDGEMENTS

Human Resources Development Canada wishes to express sincere appreciation for the contribution of the many industrial establishments, professional associations, labour organizations, tradespersons, provincial and territorial government departments and agencies, and all others who contributed, directly or indirectly, to this publication.

Special acknowledgment is extended to F.A. Embree and the staff of Consulting Services, Business and Industry Services, Humber College of Applied Arts and Technology, who developed the analysis with the assistance of the following individuals who provided industry input:

Don French	Newfoundland
Ken Sketchley	Nova Scotia
Gordon Burke	Prince Edward Island
James Larry (Jim) Wilson	New Brunswick
Michel Boutin	Quebec
Robert Strickland	Ontario
Ernie Shemeluk	Manitoba
Larry Johnson	Saskatchewan
John William (Bill) Ohe	Alberta
John King	British Columbia
John Skinner	Ontario

This analysis was prepared by the Human Resources Partnerships Directorate. The planning, coordination and processing of the analysis were undertaken by staff members of the Standards, Planning and Analysis Division.

OTHER RELATED OCCUPATIONAL TITLES

This analysis covers tasks performed by a refrigeration and air conditioning mechanic whose occupational title has been identified by some provinces and territories of Canada under the following names:

Refrigeration Mechanic
Refrigeration and Air Conditioning

LIST OF PUBLISHED OCCUPATIONAL ANALYSES *

TITLE	NOC** Code
Aquaculture Technician (1977)	2221
Arts Administrator (1989)	0114
Automotive Painter (1995)	7322
Automotive Service Technician (1995)	7321
Automotive Technician - Automatic Transmission (1990)	7321
Automotive Technician - Electrical/Electronics (1992)	7321
Automotive Technician - Engine Repair and Fuel Systems (1989)	7321
Automotive Technician - Front-End (1989)	7321
Automotive Technician - Manual Transmission, Driveline and Brakes (1990)	7321
Aviation Machinist (1994)	7331
Baker (1991)	6252
Blaster (Surface) (1987)	7372
Boilermaker (1994)	7262
Bricklayer (1993)	7281
Cabinetmaker (1992)	7272
Carpenter (1993)	7271
Cement Finisher (1995)	7282
Construction Electrician (1994)	7241
Cook (1991)	6242
Electrical Mechanic (1981)	7333
Electronics Technician Vol. I (1986) (Video Equipment)	2242
Electronics Technician Vol. II (1986) (Audio Equipment)	2242

* **Red Seal analyses are indicated in bold**

** **National Occupational Classification**

Electronics Technician Vol. III (1986) (Computer Equipment)	2242
Electronics Technician Vol. IV (1986) (Office Equipment)	2242
Electronics Technician Vol. VI (1986) (Communication Equipment)	2242
Electronics Technician Vol. VII (1986) (Signaling Equipment)	2242
Electronics Technician Vol. VIII (1986) (Navigation Equipment)	2242
Electronics Technician Vol. IX (1986) (Video Game Equipment)	2242
Electronics Technician Vol. X (1987) (CADD Equipment)	2242
Electronics Technician Vol. XI (1987) (CAM Equipment)	2242
Electronics Technician Vol. XII (1987) (Robotics Equipment)	2242
Electronics Technician Vol. XIII (1987) (Biomedical and Laboratory Equipment)	2242
Electronics Technician Vol. XIV (1987) (Industrial Process-Control Equipment)	2243
Farm Equipment Mechanic (1994)	7312
Floorcovering Installer (1991)	7295
Glazier (1994)	7292
Hairstylist (1992)	6271
Heating (Gas and Oil) Servicer - Commercial and Industrial (1978)	7331
Heavy Equipment Mechanic (1987)	7312
Heavy Equipment Operator (1983)	7421
Industrial Electrician (1987)	7242
Industrial Instrument Mechanic (1988)	2243
Industrial Mechanic (Millwright) (1996)	7311
Insulator (Heat and Frost) (1993)	7293
Ironworker (Generalist) (1993)	7264
Lather (Interior Systems Mechanic) (1994)	7284

Logistics (1992)	0713
Machinist (1992)	7231
Major Electrical Appliance Repairer (1984)	7332
Mobile Crane Operator (1992)	7371
Motorcycle Mechanic (1995)	7334
Motor Vehicle Body Repairer (1997)	7322
Motor Vehicle Repairer (Truck and Transport) (1983)	7321
New Home Builder and Residential Renovation Contractor (1992)	0712
Oil Burner Mechanic (1997)	7331
Painter and Decorator (1993)	7294
Partsperson (1995)	1472
Plumber (1996)	7251
Power Engineer (1997)	7351
Powerline Technician (1996)	7244
Refrigeration and Air Conditioning Mechanic (1997)	7313
Roofer (1991)	7291
Sheet Metal Worker (1990)	7261
Sprinkler System Installer (1995)	7252
Steamfitter-Pipefitter (1996)	7252
Steel Fabricator (Fitter) (1994)	7263
Tool and Die Maker (1992)	7232
Truck-Trailer Repairer (1994)	7321
Welder (1996)	7265

REQUESTS FOR THESE PUBLICATIONS SHOULD BE FORWARDED TO:

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FOREWORD

The first National Conference on Apprenticeship in Trades and Industries, held in Ottawa in 1952, recommended that the federal government be requested to co-operate with provincial apprenticeship committees and officials in preparing analyses of a number of skilled occupations. To this end, Human Resources Development Canada sponsors a program, under the guidance of the Canadian Council of Directors of Apprenticeship (CCDA), to develop a series of occupational analyses.

The Occupational Analysis Program has the following objectives:

- to identify and group the tasks performed by skilled workers in particular occupations;
- to identify those tasks that are performed by skilled workers in every province and territory;
- to develop instruments for use in the preparation of interprovincial standards "Red Seal" examinations and curricula for training leading to the certification of skilled workers;
- to facilitate the mobility, in Canada, of trainees and skilled workers; and
- to supply employers and employees, and their associations, industries, training institutions and governments with analyses of the tasks performed in particular occupations.

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GUIDE TO ANALYSIS

DEVELOPMENT OF ANALYSIS

A draft analysis is developed by a knowledgeable consultant who, with the assistance of a committee of industry experts in the field, identifies all the tasks performed in the occupation.

The draft is then assigned to occupational analysts at Human Resources Development Canada for review, translation and edit to ensure conformity with the nationally approved format.

The analysis is forwarded to provincial/territorial authorities for validation by specialists in the field. Their recommendations are assessed and incorporated into the final draft which also includes the identification of the common core tasks performed in the occupation.

The occupational analysis is published in both official languages.

STRUCTURE OF ANALYSIS

To facilitate the understanding of the nature of the occupation, the work performed is divided into the following divisions:

A. **BLOCK**	-	is the largest division within the analysis and reflects a distinct operation relevant to the occupation.
B. **TASK**	-	is the distinct activity that, combined with others, makes up the logical and necessary steps the worker is required to perform to complete a specific assignment within a "BLOCK".
C. **SUB-TASK**	-	is the smallest division into which it is practical to sub-divide any work activity and, combined with others, fully describes all duties constituting a "TASK".

Enabling Objectives

The element of skill and knowledge that an individual must acquire to perform the task adequately.

Trend

Any shifts or changes in technology that affect the sub-tasks are identified under this heading.

VALIDATION METHOD

At the request of the Canadian Council of Directors of Apprenticeship (CCDA), the Standardization Sub-Committee developed a method for the validation of the national Red Seal occupational analyses.

A draft of the analysis is sent to all provinces/territories for validation. Each jurisdiction rates the sub-tasks and applies percentage ratings to blocks and tasks. This method for the validation of the national occupational analyses identifies common core tasks across Canada for a specific occupation. This feature facilitates the weighting of the Interprovincial Red Seal examinations.

DEFINITIONS

YES:	the sub-task is performed.
NO:	the sub-task is not performed.
BLOCK %:	the average time a worker spends performing each block in a given year in relation to other blocks of the analysis, taking into consideration the complexity (importance plus difficulty) of the block. (See Appendices "C" and "D" for numerical and graphical representations of this specific occupation.)
TASK %:	the average time a worker spends performing each task in relation to other tasks within the block, taking into consideration the complexity (importance plus difficulty) of the task. (See Appendix "C" for numerical representation of this specific occupation.)
NV:	Not Validated by the province/territory.
ND:	Not Designated in that province/territory.

COMMON CORE

The criteria for determining common core are dependant on the performance of sub-tasks. If 70% of the responding jurisdictions (excluding NVs and NDs) perform the sub-task, it shall be considered common core.

In the analysis, Block A is reserved for safety practices. Since safety practices are a mandatory feature of all occupations, it is considered common core and ratings are not required.

Interprovincial Red Seal examinations are based on the common core identified through this validation process.

SCOPE OF ANALYSIS

This occupational analysis is directed at the work completed by refrigeration and air conditioning mechanics. It covers the commercial, industrial, residential, institutional and recreational sector. These people work in a variety of companies, government, and institutions. Refrigeration and air conditioning mechanics could be self-employed as contractors, work in pulp mills, packing plants, mines, refineries, fish plants and chemical plants. They could work for engineering and consulting firms, building management and equipment manufacturing companies. Refrigeration and air conditioning mechanics may report directly to the following people: construction foremen/supervisors, service foremen/supervisors, service managers or company owners. Reporting directly to them may be: maintenance workers, labourers and apprentices.

Refrigeration and air conditioning mechanics diagnose, repair, install and maintain a variety of refrigeration systems including: absorption, mobile, artificial ice rink and self-contained. They also diagnose, repair, install and maintain a variety of air conditioning systems including: air handling, cooling, heating, humidification, ventilation and air exchange, air cleaning and heat pump equipment. In addition, these mechanics assemble walk-in boxes and install display cases.

In order to perform these duties the mechanic will require knowledge and skills in safety and first aid, operation of trade tools and test instruments, elements of refrigeration, refrigerants and oils, codes and regulations, basic electricity and motors, troubleshooting, blueprint reading and basic drafting, welding and brazing, rigging and hoisting and trade calculations.

The mechanic will require familiarity with equipment and devices such as, compressors, condensers and receivers, evaporators, metering devices, piping of refrigeration systems, controls and control circuitry, cooling towers, circulating pumps, ice making equipment and air handling and distribution equipment.

As a result of the breadth of the occupation there may be a variety of levels of competence and some degree of specialization. This analysis covers the full range of competencies for the trade.

OBSERVATIONS AND TRENDS ARISING FROM ANALYSIS

The trend toward specialization, along with the ever increasing sophistication and new equipment being developed in the electronics industry impacts on the refrigeration and air conditioning trade. Electronic and computerized controls for systems require mechanics to become acquainted with new devices and technology. In addition, computerized monitoring and on-board diagnostics and becoming more common on system controls.

The increasing use of PVC piping in refrigeration and air conditioning and the expanding use of plastic accessories and components continues to change the trade operations.

Increasing stringency and proliferation of local codes and regulations also impacts on the refrigeration and air conditioning trade. The trend to packaged systems and prefabricated units requires new approaches, knowledge and skills in the trade. In addition, refrigeration and air conditioning units are becoming more energy efficient and environmentally safe. Ozone depleting chlorofluorocarbon (CFC) refrigerants are being replaced by non-ozone depleting substances. In addition, the phasing out of hydrochlorofluorocarbon (HCFC) refrigerants has also begun.

New legislation relating to the handling, recovery and storage of CFC refrigerant is in place and requires specialized certification and skills.

ANALYSIS

BLOCK A SAFETY AND SAFE WORKING PROCEDURES

Task 1 **Demonstrates safe working practices.**

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
1.01	Protects personal and public health and safety.	knowledge of setting up procedures on job site to safeguard public and personnel knowledge of procedures to erect and utilize scaffolds, ladders, barricades, guard rails, hoisting equipment and warning signs ability to assess work site and select required safety equipment ability to lock out electrical supply	scaffolding, ladders, hoisting equipment, rigging equipment, cranes
1.02	Assures protection from fire hazards.	knowledge of methods for extinguishing different types of fires knowledge of maintenance procedures for fire extinguishers ability to select and operate fire extinguishers ability to identify fully extinguished fire ability to locate fire alarms and exit routes ability to promote safe storage and handling of flammable materials, liquids and gases ability to maintain clear safety exits	fire extinguisher

	Sub-tasks	Enabling Objectives	Tools & Equipment
1.03	Complies with government regulations, codes and standards.	knowledge of Workplace Hazardous Materials Information Services (WHMIS) and applicable safety acts, Workers' Compensation Board (WCB) regulations and provisions for reporting accidents and fires knowledge of provincial/ territorial and federal environmental regulations when handling and disposing of refrigerant knowledge of company safety policies and procedures	
1.04	Obtains refrigerant handling certification.	ability to meet government regulated entrance requirements for certification training course ability to successfully complete government regulated certification exam ability to update and renew certification requirements	
1.05	Recognizes hazardous materials.	knowledge of types of hazardous materials and their composition knowledge of WHMIS and environmental acts regarding refrigerant ability to identify potentially harmful materials such as refrigerants, gas and oils	
1.06	Operates emergency safety equipment.	knowledge of operating procedures for emergency safety equipment knowledge of emergency phone numbers and area evacuation procedures ability to locate and operate emergency safety equipment	fire extinguisher, fire blanket, stretcher, respirator, first aid station, fire hose

	Sub-tasks	Enabling Objectives	Tools & Equipment
1.07	Applies first aid to injured person(s).	knowledge of basic first aid and location of first aid station	first aid kit, respirator
		ability to locate first aid station	
		ability to contact dispatcher and request outside assistance	
1.08	Maintains good housekeeping.	knowledge of good housekeeping practices	broom, shovel
		ability to maintain cleanliness and order in work area	
		ability to safely store tools, equipment, materials and loose objects	
		ability to remove hazards and debris from work site	
1.09	Maintains tools and equipment.	knowledge of manufacturers' recommendations for maintaining tools and equipment	tool pouch
		ability to identify defective tools such as mushroomed hammer heads, split handles and poor electrical connectors	
		ability to store tools and equipment in assigned locations	
		ability to clean and lubricate power tools	
1.10	Operates tools and equipment.	knowledge of power and hand tool operation	
		knowledge of operating procedures and limitations of tools and equipment	
		knowledge of power tool hazards	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of hand tools and their uses	
		knowledge of safe working load	
1.11	Wears personal protective equipment and clothing.	knowledge of types and uses of personal protective equipment such as hard hats, rubber gloves and goggles	hard hat, rubber gloves, safety glasses, goggles, aprons, masks, safety boots
		knowledge of the types and limits of protection of personal protection equipment	
		knowledge of operating procedures and limitations for safety equipment	
		knowledge of testing procedures for equipment and clothing	
		ability to don, fit and adjust protective equipment and clothing	
1.12	Reports injuries to supervisor.	knowledge of applicable safety acts and company policies	
		knowledge of regulations and provisions for reporting accidents and safety violations	
		knowledge of forms to be completed and information required for reports	
		ability to notify supervisor of injuries or summon outside assistance	
1.13	Handles refrigerants and compressed gases in a safe manner.	knowledge of handling procedures for refilling, storing and transporting refrigerants and gases to avoid cylinder ruptures and potentially serious damages	recovery/recycle unit
		knowledge of handling of refrigerants and gases to avoid injury and property damage	

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of ventilation requirements to prevent injury or death due to inhalation of refrigerants or gases	
	knowledge of occupational health and safety regulations	
	knowledge of environmental regulations regarding the use and recycling of refrigerants	
	knowledge of safety procedures regarding the transfer of refrigerant from one cylinder to another	
	knowledge of accessories required for handling types of gases	
1.14 Stores equipment and products in a safe manner.	knowledge of types of hazardous materials and their composition	
	knowledge of handling and storage methods to prevent damage to equipment and products	
	ability to identify hazardous material	
	ability to interpret material safety data sheets for instructions on the labelling, storage and disposing of chemicals and hazardous materials such as coolant	
1.15 Transports equipment and products in a safe manner.	knowledge of safety regulations regarding the transportation of hazardous materials	
	knowledge of procedures to notify authorities when transporting hazardous materials	
	knowledge of the importance of displaying hazardous material placards	

	Sub-tasks	Enabling Objectives	Tools & Equipment
1.16	Recognizes electrical hazards.	knowledge of potential dangers of electrical shock	
		knowledge of electrical safety codes	
		knowledge of potentially hazardous situations	

BLOCK B BASIC WORK PRACTICES

Task 2 Manages job.

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
2.01	Coordinates planning with customer.	knowledge of procedures and principles relating to business and trade related practices	
		knowledge of planning procedures using blueprints, job orders and system specifications	
		ability to schedule work according to customers' time frames	
		ability to advise customer before proceeding with work	
		ability to explain features, benefits and capacities of systems using	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		blueprints, schematics and manufacturers' specifications	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

2.02	Interprets drawings and sketches.	knowledge of mechanical and electrical symbols on sketches that indicate location of devices, routing of wiring and notes that apply to specific systems	scale rules, calculator, conversion tables
		knowledge of system drawings, codes and specifications	
		ability to interpret system specifications	
		ability to refer to drawings and sketches for location and positioning of systems, components, piping and duct work	
		ability to perform metric conversion	
		ability to identify missing elements from the sketches to determine efficiency of the design/system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

2.03	Reviews work orders.	knowledge of content of work order such as customer's name, address and phone number and type and size of system	
		ability to identify system on the work order and confirm material availability	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to identify incomplete material list ability to identify system specific tools and equipment	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
2.04	Orders equipment, parts and accessories.	knowledge of types and sizes of equipment, parts and accessories knowledge of equipment and system specifications ability to access company inventory list to confirm stocked and non-stocked items and back orders ability to select equipment to correspond to system specifications ability to requisition substitute equipment, parts and accessories	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
2.05	Maintains inventory in vehicle.	knowledge of inventory control system ability to keep an up-to-date record of in-vehicle inventory including depleted stock, returned stock, additional stock and stock to be disposed ability to maintain stock quantities ability to store equipment and accessories in order to prevent damage	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to verify vehicle is equipped with required materials for assigned job	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
2.06	Obtains permits and inspections.	knowledge of the procedures to obtain permits and inspections knowledge of types of permits such as electrical and alarm knowledge of permit acquisition process knowledge of safety regulations and inspection standards knowledge of municipal, provincial/ territorial, federal codes and by-laws ability to coordinate and document inspections	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
2.07	Develops job schedule.	knowledge of safety regulations and inspection standards knowledge of time required to complete job ability to refer to company manuals and procedures ability to sequence procedures to minimize time, cost and materials and/or equipment ability to estimate quantities and costs	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to determine inventory required ability to coordinate installations and repairs with other trades ability to coordinate commencement and completion dates with the customer, mechanic or other trades	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
2.08	Coordinates with sub-trades.	knowledge of system specification knowledge of procedures and cost of work performed by outside sub-trades knowledge of safety regulations and inspection standards ability to sequence procedures to minimize time, cost and materials ability to coordinate installations and repairs ability to communicate with outside trades	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
2.09	Expedites equipment, parts and accessories.	knowledge of system specifications knowledge of types of parts, components, equipment and accessories required for system ability to contact supplier to confirm delivery times	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to requisition equipment, parts and accessories from inventory ability to coordinate shipping and receiving dates to maintain on-site delivery schedule	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
2.10	Completes material lists.	knowledge of required information contained on material lists such as materials used, quantity, identification number and codes ability to document material specifications and quantities used ability to obtain required signatures	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
2.11	Completes service reports.	knowledge of the purpose and information required for reports ability to document work performed including the number of labour hours and materials used ability to record information such as names, dates, times, materials and identification numbers	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
2.12	Maintains customer relations.	knowledge of credit and sales terms	

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of warranties, guarantees, return policies and consumer legislation	
	ability to perform sales presentations	
	ability to respond to customer queries	
	ability to prepare forms such as return material requisitions, purchase orders and warranty claim forms	
	ability to provide customer with post sale instructions, options and suggestions	
	ability to handle customer's complaints	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 3 **Rigs equipment, tools and materials.**

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
3.01	Erects scaffolding and ladders.	knowledge of techniques and procedures to erect scaffolding and ladders knowledge of safety regulations regarding placement of scaffolding and the positioning of warning signs knowledge of manufacturers' installation and operating procedures	tool pouch, scaffolding, ladders, rigging equipment, hoisting equipment

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types, sizes and capacities of scaffolding ability to set up and secure scaffolding and ladders ability to cordon-off working area and position regulating signs	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
3.02	Establishes lift points.	knowledge of lift points knowledge of types and load limits of system(s) being moved and/or lifted ability to interpret equipment drawings and lifting instructions ability to determine lift points and strength of lift points ability to secure system/unit in hoist	hoisting equipment, socket set

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
3.03	Selects rigging and hoisting equipment.	knowledge of safe rigging and hoisting techniques and procedures knowledge of types of rigging and hoisting equipment such as come-alongs, slings and hydraulic jacks knowledge of types of rigging and hoisting equipment accessories such as cable clips, eyebolts, turn-buckles, spreader bars, equalizers and swivels knowledge of rope types and load capacities	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of load limits of system(s) being moved and/or lifted	
		knowledge of sizes and weights of systems/units being lifted	
		ability to determine weights of objects to be lifted	
		ability to select lifting equipment to match weight of object being lifted	
		ability to set up rigging and hoisting equipment	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

3.04	Ties off materials.	knowledge of techniques and procedures to tie off materials	ropes, chains
		knowledge of purpose, advantage and disadvantage of knots	
		knowledge of types and weights of systems/units and materials being lifted	
		knowledge of safety procedures when handling heavy equipment and materials	
		ability to secure equipment and materials to be lifted	
		ability to balance load	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
3.05	Operates moving and lifting equipment.	knowledge of techniques and procedures to operate moving and lifting equipment knowledge of types of moving and lifting equipment such as overhead cranes, dollies and fork lift trucks knowledge of load limits of system(s) being moved and/or lifted ability to ensure barricades and warning signs are erected and/or posted ability to communicate using hand and/or audio signals ability to set up lifting equipment ability to protect system being moved/lifted ability to identify problems with moving and lifting equipment	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	yes	yes	yes	no	NV

3.06	Directs hoisting equipment operators.	knowledge of international hand signals, terminology and movements knowledge of hoist operation ability to communicate with and direct operator using hand signals ability to operate a two-way radio ability to discuss plans and situation with operator	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	NV

Task 4 **Installs refrigerant piping/tubing.**

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
4.01	Fabricates hangers.	knowledge of techniques and procedures to fabricate hangers knowledge of types, sizes and material composition of tubing and pipe knowledge of insulation requirements of piping knowledge of refrigerant piping design knowledge of the carrying capacity of hangers ability to interpret specifications and drawings ability to measure, bend and cut wire hangers	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

4.02	Mounts hangers.	knowledge of types of ceiling and wall surfaces such as drywall, metal, concrete and wood knowledge of types, sizes and characteristics of fasteners and inserts knowledge of gauges/sizes of hangers and hanger application methods ability to interpret blueprints, drawings and specifications and identify location of hangers	tool pouch, electric drill, punch, wire benders

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to measure and cut hangers ability to install pipe hangers and supports ability to position and install hangers in steel, concrete and wood according to required frequency of supports ability to operate power tools	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

4.03	Prepares holes/passages for piping/tubing.	knowledge of techniques and procedures to drill/cut holes and/or passages for piping/tubing knowledge of system specifications, site layout, clearances and location of holes/passages knowledge of types and sizes of piping/tubing to be installed ability to interpret system specifications, diagrams and piping layout ability to mark, measure, cut and/or drill holes/passages for piping/tubing ability to verify positioning of holes/passages	tool pouch, power saw, chisel, electric drill

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

4.04	Mounts fasteners.	knowledge of techniques and procedures to mount fasteners	tool pouch, electric drill, sockets

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types, sizes and characteristics of fasteners and inserts	
		knowledge of layout, location of system and space requirements	
		ability to interpret manufacturers' specifications, diagrams and drawings	
		ability to position fasteners at designated intervals	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

4.05	Positions pipe(s).	knowledge of techniques and procedures to position pipe(s)	hoisting equipment, rigging equipment
		knowledge of system specifications, layout and space allocations	
		knowledge of hoisting and rigging techniques and procedures	
		ability to interpret manufacturers' instructions, diagrams and drawings	
		ability to support pipe using hangers	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

4.06	Swages tubing.	knowledge of techniques and procedures to swage tubing	swaging tools
		knowledge of types, sizes and material composition of tubing	
		knowledge of system specifications and layout	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to select size of tubing inserts	
		ability to use swaging tools	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
4.07	Flares tubing.	knowledge of techniques and procedures to flare tubing	flaring tools
		knowledge of types, sizes and material composition of tubing	
		knowledge of system specifications and layout	
		ability to using flaring tools	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
4.08	Threads pipe(s).	knowledge of techniques and procedures to thread pipe(s)	tool pouch, pipe thread dies, pipe threaders, pipe cutters
		knowledge of types, sizes and material composition of piping	
		knowledge of system specifications and layout	
		ability to interpret specifications for thread types	
		ability to select pipe thread dies	
		ability to use thread dies	
		ability to set up and operate powered thread pipe cutting machine	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
4.09	Cuts pipe(s)/tubing.	knowledge of techniques and procedures to cut pipe(s)/tubing knowledge of system and system layout knowledge of types, sizes and material composition of pipes/tubing ability to interpret specifications and drawings ability to mark, measure and cut pipe/tubing into specified lengths	pipe cutters, hacksaw

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

4.10	Bends pipe(s)/tubing.	knowledge of techniques and procedures to bend pipe(s)/tubing knowledge of types, sizes and material composition of piping/tubing knowledge of system specifications and layout ability to contour pipe/tubing to fit pre-designated locations ability to set up and operate tube bending jigs and machines	tube bender, bending jig

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

4.11	Reams pipe(s)/tubing.	knowledge of techniques and procedures to ream pipe(s)/tubing knowledge of types, sizes and material composition of piping/tubing	reamer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of type, sizes and applications of pipe/tubing reamers ability to remove burrs from pipe/tubing	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

4.12	Cleans pipe/tubing ends and fittings.	knowledge of techniques and procedures to clean pipe(s)/tubing ability to remove oxidization from copper pipe ability to remove contaminants such as oil and grease using chemical cleaners and mechanical processes	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

4.13	Purges system with inert gas for brazing/soldering/ welding.	knowledge of techniques and procedures to purge system with inert gas knowledge of system and its operation ability to operate nitrogen regulator ability to remove air, gas, propane and water vapour from the system	nitrogen cylinder and regulator

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

4.14	Solders pipe(s)/tubing and fittings.	knowledge of soldering techniques and procedures	soldering iron/gun, butane torch

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of function and application of soldering equipment ability to operate soldering equipment ability to select solder ability to select heating method for specific operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
4.15	Joins piping mechanically.	knowledge of techniques and procedures to join pipe(s) knowledge of types of pipe connectors/fittings such as elbows, unions, bushings and couplings ability to connect pipe	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
4.16	Brazes pipe(s)/tubing and fittings.	knowledge of techniques and procedures to braze pipe(s)/tubing knowledge of types such as gas forced air and propane of systems operation ability to operate brazing equipment ability to select brazing rods and fluxes	torch kit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
4.17	Performs pressure test on system.	knowledge of designed pressure and temperature levels ability to verify containment of temperatures and pressures ability to recognize abnormalities in system such as leaks and faulty pressure flow ability to operate test equipment ability to interpret pressure results and compare with system specifications ability to verify solder connection	pressure gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

4.18	Depressurizes system.	knowledge of techniques and procedures to depressurize refrigeration and air conditioning systems ability to open valves and release nitrogen ability to confirm pressure in piping	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

4.19	Evacuates refrigeration system.	knowledge of manufacturers' recommended techniques and procedures to evacuate refrigeration and air conditioning systems knowledge of effects of temperature, electrical connections/power	tool pouch, vacuum pump, vacuum gauge, compound gauge, micron gauge, manometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		interruptions and line sizing on evacuation knowledge of safety procedures when evacuating system ability to set up equipment ability to select and operate tools and test instruments ability to remove moisture	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
4.20	Insulates pipe(s)/tubing.	knowledge of techniques and procedures to insulate pipe/tubing knowledge of types and grades of insulation knowledge of application methods for insulation ability to apply insulation	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

BLOCK C REFRIGERATION SYSTEMS

Task 5 Designs refrigeration systems.

Trend: Towards the use of more efficient, cost effective systems.

	Sub-tasks	Enabling Objectives	Tools & Equipment
5.01	Interprets refrigerant tables, charts, diagrams, pressure-enthalpy diagrams.	knowledge of types of information contained on tables, charts and diagrams knowledge of electrical symbols, drawings and blueprint layout knowledge of refrigeration system operation ability to establish condition of refrigerant at specific parts of system from pressure-enthalpy diagram such as plotting refrigeration cycle, determining condition of refrigeration and identifying zones ability to identify and interpret data of refrigeration cycle plotted on pressure-enthalpy chart such as heat absorbed by evaporating, amount of superheat at compressor and discharge temperature ability to analyze drawings to determine location and areas of coverage ability to identify missing elements from the sketches and/or diagrams to determine efficiency of the system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
5.02	Establishes refrigeration load requirements for cooling and freezing.	knowledge of job to be performed, location and condition of site knowledge of guidelines concerning work permits ability to determine transmission of heat gain (sensible) by conduction walls, ceilings, floors time factor,	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		type of insulation, thickness of insulation, "U" factors, external architecture, temperature difference radiation: glass, solar and other materials	
		ability to determine air change loads such as inside volume and types of usage	
		ability to determine product loads such as sensible, latent, heat of respiration, cartons and containers	
		ability to determine miscellaneous loads such as occupants, lights, motors, gas and/or electrical appliances	
		ability to interpret ammeter and voltmeter charts for load requirements	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	NV

5.03	Establishes requirements for refrigeration system, including multiple systems.	knowledge of job site, layout and system requirements	
		knowledge of basic refrigeration systems and fundamentals of operation	
		knowledge of customers' requirements	
		ability to interpret blueprints and specifications	
		ability to identify conditions of refrigerant during refrigeration cycle	
		ability to identify and interpret refrigerant properties such as	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		pressure, temperature, specific volume, density, enthalpy and entropy	
		ability to plot refrigeration cycle on pressure-enthalpy diagram including sub-cooling and superheating given specific refrigerant conditions as per shop project	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
5.04	Selects refrigeration equipment, piping and accessories.	knowledge of job to be performed	
		knowledge of types and sizes of equipment, piping and accessories	
		knowledge of system specifications such as single zone, multi-zone, roof top, computer room or residential split system	
		knowledge of types of refrigerants, their characteristics and applications with types of piping materials	
		knowledge of piping methods and sizing techniques based on evaporating temperature required, capacity of system at given temperature, information and tables to establish equivalent length of piping and type of refrigerant risers	
		knowledge of refrigeration circuits of single or multiple temperature systems, multiple compressors, multiple evaporators and multiple condensers	
		knowledge of suction line piping considerations such as evaporator and	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		compressor at same level, evaporator above compressor, acceptable maximum pressure drop and recommended velocity for oil entrainment	
		knowledge of manufacturers' specifications	
		knowledge of budget restrictions and customer's specifications	
		ability to select equipment, piping and accessories to match system specifications	
		ability to interpret charts, drawings, piping diagrams including pipe sizing and pressure graph tables	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

5.05	Determines equipment layout.	knowledge of techniques and procedures to layout equipment	
		knowledge of types of refrigeration systems	
		knowledge of system specifications and manufacturers' specifications and recommended procedures	
		ability to interpret drawings, blueprints and schematics	
		ability to estimate types, sizes and capacities of equipment required for job	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to refer to customer's service file in order to identify job requirements	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
5.06	Prepares drawings and sketches.	knowledge of drafting techniques, codes and symbols	
		knowledge of required design and dimensions of system and accessories	
		knowledge of manufacturers' specifications	
		ability to refer to work order and blueprints for specifications and dimensions	
		ability to draw layout showing positioning of equipment and accessories	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
5.07	Prepares estimate.	knowledge of information contained on estimate	
		knowledge of work order, system specifications and manufacturers' product costs	
		knowledge of types and sizes of equipment, piping and accessories	
		knowledge of time required for labour	
		knowledge of work performed by outside trades	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret documentation such as manufacturers' specifications, drawings, diagrams, material list and work orders	
		ability to complete estimate showing information such as cost of equipment, materials, supplies and labour time frames	
		ability to obtain required signatures	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	NV

5.08	Submits drawings for approval.	knowledge of information contained on drawings and required signatures	
		knowledge of customer's approval regarding estimated level of service and cost limits	
		ability to discuss estimate with customer before proceeding with work	
		ability to modify drawings	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	NV

Task 6 **Diagnoses absorption system malfunctions. (NOT COMMON CORE)**

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
6.01	Inspects absorption system.	knowledge of types of absorption systems such as liquid and solid knowledge of principles of operation and parameters of performance of absorption systems knowledge of electric, electronic and pneumatic controls knowledge of absorption system energy sources such as steam, hot water and direct fired knowledge of procedures for drawing solution samples from machine knowledge of chilled water, condenser, water and energy source heat transfer rates ability to check absorption system visually, audibly and physically ability to operate test instruments	tool pouch, ammeter, voltmeter, flow meter, hydrometer, thermometer, goggles, rubber gloves, rubber boots

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
6.02	Runs on-board diagnostics.	knowledge of diagnostic techniques, procedures and testing devices knowledge of types of absorption systems and their functions knowledge of trouble-shooting methods for absorption systems knowledge of operation of on-board diagnostic control devices such as touch pad and control panel	computer terminal, printer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret original equipment and manufacturers' literature	
		ability to interpret information such as software and input status, wiring continuity and system failure	
		ability to identify and interpret fault codes	
		ability to interpret electrical wiring diagrams and schematics	
		ability to visually and physically check system and components to confirm fault code origination	
		ability to operate specialized troubleshooting instruments such as computer, key pad and printer	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
6.03	Purges non-condensibles from system.	knowledge of techniques and procedures to purge non-condensibles from absorption system	tool pouch
		knowledge of types of vacuum pumps	
		knowledge of types of oils for high vacuum pumps	
		knowledge of lithium bromide jet pumps	
		ability to operate high vacuum producing pumps	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to verify system operation	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

6.04	Checks functionality and output of electrical components.	knowledge of operating procedures for electric/electronic components knowledge of power, voltage and phase requirements knowledge of electric and electronic to pneumatic interface such as electrical pressure (E.P.) switches, pressure electric (P.E.) switches and transducers ability to interpret electrical schematics, charts, fault trees and manufacturers' recommended service manuals ability to simulate changing temperatures and pressures and monitor control action ability to check for loose, worn or frayed electrical connections ability to check electric motors and test electrical components ability to check and calibrate electric, electronic and pneumatic controls ability to interpret test results	tool pouch, voltmeter, ammeter, multimeter, pressure meter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to verify system operation	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

6.05	Checks operating temperatures and pressures.	knowledge of absorption system design, including temperature and pressure requirements knowledge of equipment manufacturers' operation and maintenance manuals knowledge of circulating fluids such as water, lithium bromide and steam glycol knowledge of allowable tolerances for design temperature, pressure and humidity ability to measure temperatures and pressures and compare with design of system ability to locate temperature and pressure fluctuations ability to identify overheating problems and impact on fluid effectiveness ability to adjust valves to meet requirements ability to set up, calibrate and operate test instruments	tool pouch, thermometer, pressure gauge, manometer, hydrometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret test results and pressure gauges	
		(NOT COMMON CORE)	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
6.06	Checks capacity control system.	knowledge of types of capacity controls used on absorption systems such as condenser water control, steam control, high temperature water control, solution bypass control, direct fired burner control, bypass economizer and in-line economizer ability to interpret manufacturers' specifications, charts and diagrams ability to check and calibrate electric, electronic and pneumatic flow controls and the valves actuated by them ability to interpret test results	tool pouch, thermometer, voltmeter, multimeter
		(NOT COMMON CORE)	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
6.07	Verifies fluid flow.	knowledge of sound, temperature and performance of absorption system with normal fluid flows knowledge of types of flow measuring devices such as flow meters and flow versus pressure drop charts	tool pouch, infrared thermometer, flow meter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret prints, schematics, graphs, charts and tables ability to determine fluid flows from sound, temperature and performance of the absorption system **(NOT COMMON CORE)**	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
6.08	Checks concentration of solution.	knowledge of equilibrium diagram ability to interpret manufacturers' specifications, charts, graphs, tables and diagrams ability to interpret and classify solution samples such as weak, intermediate and strong ability to plot solution samples on equilibrium chart **(NOT COMMON CORE)**	tool pouch, hydrometer, thermometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
6.09	Checks functionality of burner components.	knowledge of energy source such as oil, natural gas and propane gas knowledge of types of burner components knowledge of electric and electronic controls for burners	flue gas analyser

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of flue gas analyzers ability to interpret manufacturers' instructions and troubleshooting guide for burner system and possible malfunctions ability to identify malfunctions of burner components	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

6.10	Determines cause of failure.	knowledge of types of absorption system components such as generator, separator, gas and liquid heat exchanger, absorber, condenser, evaporator, defroster, system controls, rectifier, analyzer, valves, piping tubing and pumps knowledge of manufacturers' specifications and operating procedures knowledge of types of potential malfunctions in absorption systems ability to interpret graphs, charts, schematics and tables ability to identify worn, misaligned, corroded and malfunctioning components and observe loose connections and fittings ability to operate testing and measuring equipment ability to check operation of safety controls	tool pouch, voltmeter, manifold pressure gauge, ohmmeter, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret diagnostic test procedures	
		ability to test electrical components	
		ability to isolate problem to specific area/component	
		ability to analyze findings	
		ability to report cause of failure	
		(NOT COMMON CORE)	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

6.11	Determines repair requirements.	knowledge of work to be performed, length of repair and time required	
		knowledge of area of system to be repaired such as electrical, temperature and pressure controls, evaporator, valves and burners	
		knowledge of cost of system components and part availability	
		knowledge of warranty coverage	
		ability to determine if components should be repaired or replaced	
		ability to isolate problem to specific area	
		ability to interpret diagnostic test procedures	

Sub-tasks		Enabling Objectives	Tools & Equipment
		ability to prepare estimate including list of parts, cost of repair and time required for repair	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

6.12	Determines warranty status.	knowledge of service and system warranty limits such as time, and degree of reimbursement knowledge of company policies regarding warranty of absorption systems and service and use of used accessories/parts knowledge of general periods of warranty for parts, components and systems knowledge of extended or specific warranties that apply to absorption system or individual components of system ability to locate and identify accessory, component and system information such as model number, serial number, manufacturer, voltage, phase, size, quantity and capacity ability to provide reason for part failure or request for warranty such as incorrect size, defective part or broken connections ability to obtain original invoices and work orders to identify installation date, supplier, manufacturer and terms of warranty	

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to discuss system with owner and original equipment supplier ability to contact manufacturer for warranty status requirements such as part return information and warranty cards ability to complete warranty card(s)	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

Task 7 **Overhauls absorption systems. (NOT COMMON CORE)**

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
7.01	Shuts down system, including lock out.	knowledge of techniques and procedures to shut down and lock out absorption systems knowledge of types of absorption systems such as liquid and solid type systems knowledge of electrical distribution panel and its purpose knowledge of site specific lock out requirements knowledge of type of utilities such as gas, water, steam, heat, oil and propane	tool pouch, padlock

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of code requirements and operating specifications for utilities	
		knowledge of energy sources in steam, hot water and gas isolating devices	
		knowledge of manufacturers' specifications	
		ability to ensure electrical and energy sources are isolated	
		ability to determine required component isolation and sequence of isolation depending on expected repair(s)	
		ability to identify locations of primary and secondary utility isolation devices such as electrical disconnects and breakers, oil, propane, natural gas and steam supply valves	
		ability to mechanically lock out isolation devices and to label in sequence	
		(NOT COMMON CORE)	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
7.02	Isolates absorption systems.	knowledge of techniques and procedures to isolate absorption system	tool pouch, pressure gauge, padlock, multimeter, ammeter
		knowledge of site specific system and layout	
		knowledge of system components such as generator, separator, gas and liquid heat exchanger, absorber,	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		condenser, evaporator, defroster, system controls, rectifier, analyzer, valves, piping, tubing and pumps knowledge of shut down and start up procedures ability to disengage system in order to repair system/component	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

7.03	Recovers lithium bromide solutions.	knowledge of techniques and procedures to recover lithium bromide solutions knowledge of absorption system vacuum breaking procedures knowledge of safe operation of nitrogen and pressure reducing equipment knowledge of handling, storage and transportation methods when handling lithium bromide solutions ability to break system vacuum with nitrogen	tool pouch, hoses, CO_2 cylinder and regulator, nitrogen cylinder and regulator, manifold pressure gauge

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

7.04	Disassembles absorption systems.	knowledge of techniques and	tool pouch, rigging equipment, hoisting

	Sub-tasks	Enabling Objectives	Tools & Equipment
		procedures to disassemble absorption systems	equipment, come-along, slings
		knowledge of types of absorption systems such as liquid and solid	
		knowledge of components of absorption system such as hermetic and open pumps, pump seals, motors, diaphragm and gate valves	
		ability to identify defective components	
		ability to operate rigging and hoisting equipment	
		ability to maintain sequential order when disassembling absorption system components	
		ability to mark components in order to reassemble in sequence	
		(NOT COMMON CORE)	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
7.05	Inspects absorption system components.	knowledge of types and sizes of absorption system components	tool pouch
		knowledge of installation and manufacturers' specifications, prints, diagrams, charts, tables and schematics	
		ability to identify worn, corroded, loose or malfunctioning components	
		ability to check alignment of components and make adjustments	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to lubricate components ability to assess system operation **(NOT COMMON CORE)**	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
7.06	Selects replacement components.	knowledge of types and sizes of absorption system components knowledge of manufacturers' specifications knowledge of equipment capabilities, compatibility and requirements ability to select component to match system type **(NOT COMMON CORE)**	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
7.07	Repairs components.	knowledge of techniques and procedures to repair components knowledge of types, sizes, capacities and capabilities of absorption system components ability to interpret manufacturers' specifications ability to disassemble system in sequential order ability to check operation of valves	tool pouch, multimeter, ammeter, pressure gauge, thermometer, psychrometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to check intake tubes for damage, cracks, leaks and missing or inoperative components ability to disassemble, reassemble components ability to adjust and test component ability to replace fastening devices ability to lubricate components ability to verify system and component operation **(NOT COMMON CORE)**	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

7.08	De-crystallizes heat exchanger.	knowledge of techniques and procedures to de-crystallize heat exchanger/vessel knowledge of lithium bromide solution ability to heat vessel or heat exchanger ability to measure gravity ability to take samples ability to adjust consistency of charge ability to check for leaks **(NOT COMMON CORE)**	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
7.09	Replaces defective components.	knowledge of techniques and procedures to replace defective components knowledge of types, sizes and capabilities of components ability to interpret manufacturers' specifications, blueprints, schematics and charts ability to disassemble components needing replacement ability to select components to meet system requirements ability to select and operate tools ability to verify operation of component and system ability to lubricate and clean components	tool pouch, alignment tools, multimeter, pressure gauge, flow meter

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

7.10	Reassembles absorption systems.	knowledge of assembly sequences, techniques and procedures for absorption systems knowledge of manufacturers' designed operating conditions knowledge of rigging and hoisting ability to interpret manufacturers' specifications, procedures and adjustment instructions	tool pouch, alignment tools, rigging equipment, hoisting equipment

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to select and operate tools ability to align, attach and secure components ability to verify system operation **(NOT COMMON CORE)**	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
7.11	Checks for air leaks.	knowledge of techniques and procedures to check for air leaks knowledge of impact of air and vacuum leaks on absorption systems knowledge of types of absorption systems ability to check for cracks, vacuum leaks, clear channels and heat crossovers ability to inspect air intake systems such as intake manifold, manifold pre-heating system, air cleaning systems and heated air systems ability to pressurize with nitrogen ability to conduct bubble test **(NOT COMMON CORE)**	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
7.12	Arranges for re-certification of condenser.	knowledge of types, sizes and operation of condensers such as air, water, refrigerant and evaporative cooled knowledge of functions of condensers knowledge of re-certification requirements for types of systems, components and applications ability to interpret prints, tables, diagrams and schematics ability to arrange for inspections and testing with authorities	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

Task 8 Installs absorption systems. (NOT COMMON CORE)

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
8.01	Removes shipping materials.	knowledge of techniques and procedures for handling absorption systems knowledge of manufacturers' procedures to remove shipping materials knowledge of hoisting and rigging techniques and procedures	tool pouch, crow bar, utility knife

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to unload material and/or equipment at assigned location ability to identify and report damages and/or shortages ability to dispose of waste materials	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
8.02	Verifies absorption system specifications.	knowledge of types of absorption systems such as liquid and solid and system components knowledge of job site cooling, voltage and load requirements knowledge of energy sources such as steam, hot water, oil and gas knowledge of manufacturers' specifications ability to interpret system specifications and compare with unit nameplate ability to confirm that system and equipment correspond to specified materials on site such as size, capacity, voltage, phase, pressures, fuels, safety certification, standards and codes ability to identify and report damages and/or shortages	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
8.03	Positions system by rigging and hoisting.	knowledge of techniques and procedures to rig and hoist devices knowledge of system specifications and/or work order knowledge of location and placement for absorption system knowledge of hand signals ability to operate equipment such as a winch, hoist and block and tackle ability to communicate with crane operator ability to tie off device for hoisting ability to position device without causing damage **(NOT COMMON CORE)**	rigging equipment, hoisting equipment, winch, block and tackle

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

8.04	Levels system.	knowledge of techniques and procedures to level devices knowledge of equipment manufacturers' specifications knowledge of methods for checking machine slope such as bubble levels and water tube levels ability to interpret manufacturers' installation manual for levelling device(s) ability to align, level and adjust machine level	tool pouch, hoisting equipment, crane, hydraulic jacks, socket set, levels

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret level readings	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

8.05	Mounts controls and valves.	knowledge of techniques and procedures to mount controls and valves knowledge of rigging and hoisting techniques and procedures knowledge of electric, electronic and pneumatic controls knowledge of types of fasteners for mounting controls and valves to materials such as concrete, drywall and wood ability to ensure that controls and valves are protected and in a serviceable location ability to align and level while mounting	tool pouch, drill, levels, rigging equipment, hoisting equipment

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

8.06	Hooks up utilities.	knowledge of techniques and procedures to hook up utilities knowledge of power, voltage and phase requirements knowledge of municipality permits and regulations	tool pouch

Sub-tasks		Enabling Objectives	Tools & Equipment
		knowledge of types of utilities, contact person and required documentation ability to interpret blueprints, specifications and electrical codes and symbols ability to attach utilities to hardware and piping ability to verify connections according to company standards and manufacturers' specifications **(NOT COMMON CORE)**	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	no	yes	no	NV

Sub-tasks		Enabling Objectives	Tools & Equipment
8.07	Connects piping.	knowledge of types and sizes of piping including attachments and fasteners knowledge of piping methods and sizing techniques knowledge of site design, layout and access locations ability to interpret blueprints and specifications ability to estimate type and amount of piping ability to make piping connections **(NOT COMMON CORE)**	tool pouch, tube cutters, reamer, bending tools, pipe threaders tools, torch kit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
8.08	Checks piping connections.	knowledge of piping connection techniques and procedures knowledge of piping diagrams including codes and symbols ability to interpret blueprints, diagrams, schematics and specifications ability to verify and adjust connections ability to check for defects/damage **(NOT COMMON CORE)**	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
8.09	Evacuates non-condensible from system.	knowledge of manufacturers' procedures to evacuate non-condensibles from system knowledge of safety procedures when evacuating system knowledge of effects of temperature, electrical connections/power interruptions and line sizing on evacuation ability to set up equipment ability to remove non-condensibles from system **(NOT COMMON CORE)**	vacuum pump, manifold pressure gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	yes	yes	no	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
8.10	Arranges for certification.	knowledge of certification requirements for absorption systems, components and applications knowledge of applicable local utility codes for application of absorption systems knowledge of types, sizes and operation of absorption systems ability to arrange for inspections and testing by authorized personnel	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
no	yes	no	no	no	yes	no	no	yes	yes	no	NV

Task 9 Installs primary refrigerant systems.

Trend: Towards the use of energy efficient and environmentally safe systems.

	Sub-tasks	Enabling Objectives	Tools & Equipment
9.01	Certifies primary refrigerant system.	knowledge of local codes and utilities knowledge of types of primary refrigerant systems and refrigerants knowledge of manufacturers' operating instructions and specifications knowledge of components such as condensing unit, evaporator coil, refrigerant control, piping and fittings, drier and liquid indicators, electric wiring and controls	

Sub-tasks		Enabling Objectives	Tools & Equipment
		knowledge of energy efficient components knowledge of heat reclaim systems ability to interpret blueprints and specifications ability to assess primary refrigerant system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

9.02	Aligns drives.	knowledge of techniques and procedures to align drives knowledge of types of drives such as belt and direct knowledge of manufacturers' specifications ability to position drives allowing space for connections ability to operate rigging and hoisting equipment ability to set up and operate alignment tools ability to make minor adjustments	tool pouch, dial indicator, micrometer, alignment tools, rigging equipment, hoisting equipment

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

9.03	Evacuates system.	knowledge of manufacturers' procedures to evacuate primary system	tool pouch, vacuum pump, vacuum gauge, compound gauge, micron gauge, manometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of effects of temperature, electrical connections/power interruptions and line sizing on evacuation knowledge of safety procedures when evacuating system ability to set up equipment ability to select and operate tools and test instruments ability to remove moisture	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
9.04	Performs leak test on system.	knowledge of techniques and procedures to perform leak test on primary refrigerant system knowledge of types of leak test methods such as halide torch, electronic, ultrasonic and soap solution knowledge of types of refrigerants knowledge of manufacturers' specifications, guidelines and safety precautions ability to select, set up and operate leak detecting equipment ability to interpret test results ability to determine source of leaks	manifold pressure gauge, leak test instruments

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
9.05	Pipes in major components.	knowledge of site location, layout and design features knowledge of types of components such as condensing unit, evaporator coil, refrigerant control, drier and liquid indicators and controls knowledge of types and sizes of piping/tubing knowledge of techniques and procedures to braze, solder and weld pipe/tubing knowledge of blueprints, schematics and drawings ability to interpret manufacturers' specifications, blueprints and schematics ability to select piping/tubing, hardware and fittings ability to swage, flare, thread, cut, bend and ream pipes/tubing ability to connect piping/tubing to components	tool pouch, pipe cutters, pipe threaders, pipe dies, bending tools and springs, reamer, swaging tools, flaring tools, soldering equipment, welding equipment

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

9.06	Connects utilities.	knowledge of techniques and procedures to connect utilities knowledge of power, voltage and phase requirements knowledge of permits, regulations and required documentation	tool pouch, voltmeter, ammeter, ohmmeter, multimeter, pipe cutters

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types of utilities such as water and electrical	
		knowledge of types and sizes of piping, hardware and fittings	
		ability to interpret blueprints, specifications and electrical codes and symbols	
		ability to hook up utilities to primary system	
		ability to verify connections according to company standards and procedures	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	NV

9.07	Positions major equipment.	knowledge of system specifications/work order, layout and access locations	tool pouch, hoisting equipment, rigging equipment, alignment tools
		knowledge of techniques and procedures to position major equipment or packaging	
		knowledge of types of equipment such as compressors, evaporators, chillers and condenser	
		knowledge of hoisting and rigging techniques and procedures	
		knowledge of local code requirements	
		knowledge of hand signals	
		ability to interpret work order, blueprints and specifications	

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to unload material and/or equipment at assigned location(s)	
	ability to operate equipment such as a winch and hoist	
	ability to position, level and align equipment	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 10 Constructs secondary refrigeration systems for artificial ice rinks.

Trend: Towards more energy efficient and environmentally controlled secondary refrigerants.

	Sub-tasks	Enabling Objectives	Tools & Equipment
10.01	Installs heating grids.	knowledge of techniques and procedures to install heating grids	tool pouch, air compressor, transit level, laser level
		knowledge of types of heating grids such as recirculated or electrical	
		knowledge of manufacturers' specifications	
		ability to interpret blueprints and specifications	
		ability to measure, position and level heating grids	
		ability to communicate with sub-trades	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
10.02	Prepares piping beds.	knowledge of manufacturers' specifications knowledge of techniques and procedures to backfill area knowledge of allowable tolerances for levelling beds knowledge of procedures to test pressure of heating grid piping ability to interpret blueprints, schematics, charts and drawings ability to test electrical heating grid ability to communicate with sub-trades ability to maintain pressure test during backfill and gravel bed preparation	tool pouch, pressure gauge, air compressor, transit level, laser level

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
10.03	Insulates piping beds.	knowledge of techniques and procedures to insulate gravel beds knowledge of insulation value thicknesses, such as "R" factors knowledge of placement of insulation knowledge of measuring and cutting techniques and procedures ability to measure area and cut insulation to size	tool pouch, utility knife

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
10.04	Positions sleepers or pipe spacers.	knowledge of techniques and procedures to position sleepers or pipe spacers knowledge of types of floor grids such as electrical or plastic piping knowledge of blueprints, layout of ice rink and drawings ability to place sleepers or pipe spacers at predetermined locations ability to align and level sleepers or pipe spacers	transit level, laser level

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
10.05	Installs headers, secondary refrigerant lines and pumps.	knowledge of job site specifications, layout and access locations knowledge of types, sizes and capacities of headers, refrigerant lines and pumps knowledge of techniques and procedures to install headers, secondary refrigerant lines and pumps knowledge of levelling techniques and procedures knowledge of secondary refrigerant flow rates knowledge of municipality permits and regulations knowledge of company policies and regulations for labelling	tool pouch, electric drill, power saw, pressure gauge, ammeter, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to check pumps for operation, leaks and pressure output	
		ability to interpret system specifications, charts, diagrams and schematics	
		ability to confirm specifications meet design and installation practices	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
10.06	Installs pipe chairs.	knowledge of techniques and procedures to position pipe chairs	tool pouch, tin snips
		knowledge of system specifications, layout, design and placement of pipe chairs	
		ability to align and position pipe chairs	
		ability to trim pipe chairs	
		ability to check alignment and position in predetermined location	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
10.07	Runs plastic piping and fittings.	knowledge of site layout, design and access locations	tool pouch
		knowledge of types, sizes and characteristics of piping and fittings	
		knowledge of levelling techniques and procedures	
		ability to determine type, size and amount of piping needed	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret system specifications for placement of pipe and fittings	
		ability to attach and secure fittings	
		ability to assess positioning of piping in order to guard against damage	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

10.08	Performs leak test on brine lines.	knowledge of pressure test limitations on brine lines	tool pouch, pressure gauge, air compressor and regulator
		knowledge of techniques and procedures to perform air or hydro static test	
		ability to maintain pressure test to ensure leaks do not develop on the brine lines	
		ability to repair leaks on the brine lines	
		ability to interpret gauge readings	
		ability to verify system operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

10.09	Monitors pouring of concrete floor.	knowledge of system specifications	
		knowledge of outside trades involved such as construction or plumbing trade	
		knowledge of purposes of consulting with trades	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of provincial/territorial and municipal building codes knowledge of company safety policies and procedures and legal implications ability to coordinate installation of pouring of concrete floors with outside trades ability to oversee pouring of concrete floors ability to verify completion of work	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

10.10	Charges secondary system with secondary refrigerant.	knowledge of types of secondary system refrigerants such as brine solutions, glycols and inhibitors knowledge of concentration of secondary refrigerant knowledge of approved methods, techniques and procedures for charging secondary refrigerant ability to interpret manufacturers' specifications, charts and diagrams ability to replenish secondary refrigerants in secondary applications ability to confirm charge ability to set up, calibrate and operate charging equipment	tool pouch, charging pump, hydrometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to label system with secondary refrigerant details	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

10.11	Bleeds air from secondary refrigerant system.	knowledge of system and its intended application knowledge of types of purge units such as manual, automatic, and approved purging methods for secondary refrigerants knowledge of types of secondary refrigerants knowledge of permanent or temporary auto purgers ability to set up and operate test equipment ability to perform operational check	tool pouch, pressure gauge, purging unit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

10.12	Starts up system.	knowledge of system operating parameters and manufacturers' specifications knowledge of design specifications for secondary refrigerant flow rates ability to interpret manufacturers' specifications, charts and diagrams ability to confirm operation is within specifications	tool pouch, pressure gauge, thermometer, ammeter, hydrometer, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to recognize anomalies in start up through visual and auditory inspection	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
10.13	Adjusts controls.	knowledge of techniques and procedures to adjust controls knowledge of types of controls such as pressure and temperature knowledge of system design specifications and control functions ability to interpret manufacturers' specifications, charts and diagrams	tool pouch, ammeter, pressure gauge, voltmeter, thermometer, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

Task 11 Diagnoses mobile system malfunctions.

Trend: Towards more energy efficient systems.

	Sub-tasks	Enabling Objectives	Tools & Equipment
11.01	Inspects mobile systems visually and audibly.	knowledge of types of mobile systems such as built-in or retrofitted units knowledge of manufacturers' specifications on electric or gas driven cooler/freezer mobile systems	tool pouch, pressure gauge, thermometer, ammeter, voltmeter, multimeter, alignment tools

Sub-tasks		Enabling Objectives	Tools & Equipment
		ability to identify worn, defective, corroded, loose or malfunctioning components	
		ability to check alignment of components	
		ability to lubricate components	
		ability to assess system operation	
		ability to make minor adjustments to mechanical component controls	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

Sub-tasks		Enabling Objectives	Tools & Equipment
11.02	Interprets operating manuals.	knowledge of types and capacities of mobile systems	
		knowledge of electric or gas driven cooler/freezer mobile systems	
		knowledge of codes and symbols used for layout of devices, location and routing of wiring and special notes	
		ability to interpret information contained in operating manuals such as blueprints, charts, graphs and schematics	
		ability to assess information such as diagnose malfunctions, repair and testing procedures	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

Sub-tasks		Enabling Objectives	Tools & Equipment
11.03	Runs on-board diagnostics.	knowledge of diagnostic techniques, procedures and testing devices	computer terminal, printer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types of mobile systems and their functions knowledge of trouble-shooting methods for mobile systems knowledge of operation of on-board diagnostic control devices such as touch pad and control panel ability to interpret original equipment and manufacturers' literature ability to interpret information such as software and input status, wiring continuity and system failure ability to obtain and interpret manufacturers' diagrams, specifications and instructions to aid in troubleshooting diagnoses ability to identify and interpret fault codes, electrical wiring diagrams and schematics ability to visually and physically check system and components to confirm fault code origination ability to operate specialized troubleshooting instruments such as computer, key pad and printer	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

11.04	Checks electrical components.	knowledge of operating procedures for electrical/electronic components knowledge of mobile system components such as thermistors, electronic and mechanical	tool pouch, voltmeter, ammeter, ohmmeter, multimeter, pressure gauge

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret electrical schematics, charts, fault trees and manufacturers' recommended service manuals ability to identify electrical symbols ability to simulate changing temperatures and pressures and monitor control action ability to check for loose, worn or frayed electrical connections ability to check electric motors and test electrical components ability to interpret test results ability to check and calibrate electric, electronic and pneumatic controls	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

11.05	Checks operating temperatures, pressures and humidity.	knowledge of system design pressures, temperatures and humidity requirements knowledge of allowable tolerances for design temperature, pressure and humidity knowledge of valve types such as thermostatic expansion valves, hot gas bypass, automatic expansion valves, capacitor, pressure regulator, crank case pressure regulating ability to locate faults such as temperature and pressure fluctuations	tool pouch, pressure gauge, thermometer, psychrometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to identify overheating problems and impact on fluid effectiveness ability to adjust valves to meet requirements ability to set up, calibrate and operate test instruments ability to interpret test results and pressure gauges	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
11.06	Checks capacity control system.	knowledge of types of capacity controls used on mobile systems such as mechanical unloading of compressors and hot gas bypass knowledge of system and its intended application knowledge of manufacturers' specifications knowledge of location of capacity controls ability to check and calibrate electric, electronic and pneumatic flow controls and the valves actuated by them ability to interpret electrical wiring diagrams and schematics ability to verify valve and nozzle sizes meet system specifications	tool pouch, pressure gauge, multimeter, ammeter, thermometer, voltmeter, milliamp meter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
11.07	Checks drive system.	knowledge of types of drive systems such as belt drive, variable speed pulleys, direct drive fans and compressors knowledge of drive system components such as belts, linkages, electric motor, clutches, diesel engine and hydraulics knowledge of existing system and its intended application knowledge of required tolerances for belt and direct drive systems ability to interpret manufacturers' specifications, diagrams and instructions ability to verify alignment and balance of drive assembly ability to check electric motors ability to check and calibrate electric, electronic and pneumatic controls ability to calculate and measure system component speeds ability to set up and operate alignment tools and measuring instruments	tool pouch, manometer, velometer, vibration analysis equipment, straight edge, voltmeter, ammeter, megger, thermometer, psychrometer, multimeter, tachometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

11.08	Verifies fluid flow.	knowledge of performance of mobile system with normal fluid flows knowledge of types of flow measuring devices such as flow	tool pouch, infrared thermometer, pressure gauge

Sub-tasks	Enabling Objectives	Tools & Equipment
	meters and flow versus pressure drop charts ability to interpret prints, schematics, graphs, charts and tables ability to determine fluid flows from sound, temperature and performance of the mobile system ability to measure temperature difference along piping	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

Sub-tasks	Enabling Objectives	Tools & Equipment
11.09 Adjusts controls for product requirements.	knowledge of original design and product features knowledge of types of controls used on mobile systems such as thermostat type humidistat pressure control knowledge of techniques and procedures to adjust controls knowledge of manufacturers' specifications ability to check and calibrate electric, electronic and pneumatic flow controls and the valves actuated by them ability to operate test equipment ability to interpret test results	tool pouch, thermometer, voltmeter, milliamp meter, pressure gauge, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
11.10	Determines cause of failure.	knowledge of types of mobile systems such as built-in and retrofitted units	tool pouch, voltmeter, manifold pressure gauge, ohmmeter, multimeter
		knowledge of manufacturers' specifications and operating procedures	
		knowledge of types of potential malfunctions in mobile systems	
		ability to identify worn, misaligned, corroded and malfunctioning components	
		ability to interpret graphs, charts, schematics and tables	
		ability to operate testing and measuring equipment	
		ability to test electrical components and observe loose connections and fittings	
		ability to isolate problem to specific area/component	
		ability to interpret diagnostic test procedures	
		ability to report cause of failure	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

11.11	Determines repair requirements.	knowledge of work to be performed, length of repair and time required	
		knowledge of manufacturers' specifications	
		knowledge of area of system to be repaired such as electrical,	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		mechanical, temperature and pressure controls knowledge of cost of system components and part availability knowledge of warranty coverage ability to determine if components should be repaired or replaced ability to interpret diagnostic test procedures ability to isolate problem to specific area ability to prepare an estimate including list of parts, cost of repair and time required for repair	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
11.12	Determines clean-up procedures.	knowledge of types of refrigerant knowledge of filter drier capacities ability to interpret oil and refrigerant analysis reports ability to change oil/refrigerant ability to braze and weld	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
11.13	Determines warranty status.	knowledge of service and system warranty limits such as time, and degree of reimbursement	

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of company policies regarding warranty of mobile systems and service and use of used accessories/parts	
	knowledge of general periods of warranty for parts, components and systems	
	knowledge of extended or specific warranties that apply to mobile systems or individual components of system	
	ability to locate and identify accessory, component and system information such as model number, serial number, manufacturer, voltage, phase, size, quantity and capacity	
	ability to provide reason for part failure or request for warranty such as incorrect size, defective part or broken connections	
	ability to obtain original invoices and work orders to identify installation date, supplier, manufacturer and terms of warranty	
	ability to discuss system with owner and original equipment supplier	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

Task 12 **Overhauls mobile systems.**

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
12.01	Shuts down system.	knowledge of techniques and procedures to shut down and lock out mobile systems knowledge of types of mobile systems such as built-in and retrofitted units knowledge of manufacturers' specifications ability to interpret prints, graphs, charts, schematics and tables ability to identify assemblies and components ability to determine fundamentals of operation of each ability to ensure electrical and energy sources are isolated	tool pouch, padlock

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

12.02	Isolates system.	knowledge of techniques and procedures to isolate mobile systems knowledge of system components knowledge of shut down and start up procedures ability to interpret manufacturers' specifications, charts, tables and schematics ability to adjust or loosen off adjoining parts ability to disengage system in order to carry out repairs	tool pouch, pressure gauge, padlock, multimeter, ammeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to recognize normal and abnormal operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
12.03	Recovers refrigerant.	knowledge of types of refrigerants and their composition knowledge of techniques and procedures to recover and recycle refrigerants knowledge of safety procedures and precautions when recovering refrigerant ability to operate refrigerant recovery equipment ability to interpret refrigerant management instructions ability to connect retrieval and storage systems ability to recover and recycle refrigerants	tool pouch, hoses, pressure gauge, recovery/recycle unit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
12.04	Disassembles unit.	knowledge of techniques and procedures to disassemble mobile systems knowledge of types of mobile system components such as electric or gas driven cooler/freezer knowledge of manufacturers' specifications	tool pouch, rigging equipment, hoisting equipment, come-along, slings

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of pipe connections and fittings ability to identify defective components ability to operate rigging and hoisting equipment ability to maintain sequential order when disassembling mobile system components ability to mark components in order to reassemble in sequence	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

12.05	Inspects mobile system components electrically.	knowledge of operating procedures for electric/electronic components knowledge of types of mobile systems and components ability to interpret electrical diagrams, schematics, charts, fault trees and manufacturers' recommended service manuals ability to simulate changing temperatures and pressures and monitor control action ability to check operation of controls and components in a sequential manner to assure designed operation ability to check electric motors and electrical components for loose, worn or frayed electrical connections ability to check and calibrate electric, electronic and pneumatic controls	tool pouch, voltmeter, multimeter, ammeter, pressure gauge

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret test results	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
12.06	Inspects mobile system components mechanically.	knowledge of types and sizes of mobile system components knowledge of manufacturers' specifications ability to identify worn, corroded, loose or malfunctioning components ability to check alignment of components ability to lubricate components ability to assess system operation ability to make minor adjustments to mechanical component controls	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
12.07	Aligns drive systems.	knowledge of techniques and procedures to align mobile systems knowledge of manufacturers' specifications ability to position system allowing space for connections ability to adjust system controls and valves	alignment tools

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
12.08	Lubricates drive systems.	knowledge of system specifications and system application knowledge of the location of components knowledge of types and uses of lubricants ability to interpret manufacturers' specifications, diagrams and instructions for lubricating drive systems ability to select lubricants ability to identify the quantity and frequency schedule for lubricating	tool pouch, grease gun

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

12.09	Repairs drive system components.	knowledge of techniques and procedures to repair drive system components knowledge of types of drive systems such as belt drive, variable speed pulleys, direct drive fans and compressors knowledge of drive system components such as belts, linkages, electric motor, clutches, diesel engine and hydraulics knowledge of required tolerances for belt and direct drive systems ability to interpret manufacturers' specifications, diagrams and repair instructions	tool pouch, manometer, velometer, vibration analysis equipment, straight edge, voltmeter, ammeter, megger, multimeter, thermometer, psychrometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to replace electric, electronic and pneumatic controls	
		ability to select and operate tools and equipment	
		ability to adjust component and verify operation of system/component	
		ability to replace fastening devices	
		ability to lubricate components	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

12.10	Performs oil analysis.	knowledge of techniques and procedures to perform oil analysis	tool pouch, pressure gauge, test kit
		knowledge of types of mobile systems	
		knowledge of types, grades and applications of oil	
		ability to interpret manufacturers' specifications, charts, diagrams and tables	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

12.11	Repairs mobile system components.	knowledge of techniques and procedures to repair components	tool pouch, multimeter, ammeter, pressure gauge, psychrometer
		knowledge of types, sizes, capacities and capabilities of mobile system components	
		knowledge of manufacturers' specifications on electric or gas driven cooler/freezer mobile systems	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret manufacturers' specifications, charts and diagrams ability to disassemble system in sequential order ability to make minor adjustments to components ability to verify that repaired component is operable ability to replace fastening devices ability to lubricate components	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

12.12	Replaces mobile system components.	knowledge of types and sizes of mobile system components knowledge of techniques and procedures to replace components knowledge of electric or gas driven cooler/freezer mobile systems ability to interpret manufacturers' specifications, charts and diagrams ability to disassemble and assemble components ability to isolate component ability to thread and solder ability to check operation of components such as valves and drives ability to make adjustments to components after replacement	tool pouch, alignment tools, multimeter, ammeter, ohmmeter, soldering equipment

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to replace fastening devices ability to verify operation of component/system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
12.13	Reassembles unit(s).	knowledge of techniques and procedures to reassemble units knowledge of operation of mobile systems knowledge of types and sizes of components and their function knowledge of electrical and installation codes ability to interpret manufacturers' specifications, procedures and instructions ability to operate tools and equipment ability to connect components and make required adjustments ability to align, attach and secure components to system	tool pouch, level, electric drill, alignment tools, rigging equipment, hoisting equipment

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
12.14	Performs leak test on mobile systems.	knowledge of techniques and procedures to perform leak test on mobile system knowledge of types of leak test methods such as halide torch,	tool pouch, manifold pressure gauge, leak detectors

	Sub-tasks	Enabling Objectives	Tools & Equipment
		electronic, ultrasonic and soap solution knowledge of types of refrigerants knowledge of manufacturers' specifications, guidelines and safety precautions ability to select, set up and operate leak detecting equipment ability to interpret test results ability to determine source of leaks	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
12.15	Evacuates repair.	knowledge of manufacturers' procedures to evacuate mobile system knowledge of safety procedures when evacuating system ability to set up equipment ability to select and operate tools and test instruments	tool pouch, vacuum pump, vacuum gauge, compound gauge, micron gauge, manometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
12.16	Recharges mobile system.	knowledge of methods of charging system such as sight glass, superheat method, liquid level, sub-cooling and cross line knowledge of charging equipment such as graduating cylinder, weigh scale, thermometer and pressure gauge	tool pouch, multimeter, ammeter, manifold pressure gauge, thermometer, weigh scale, oil pump, circulating pump, hydrometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of legislation with respect to refrigerants	
		knowledge of types of refrigerants such as ammonia, hydroflorocarbon (HFC), chloroflorocarbon (CFC) and hydrochloro-fluorocarbon (HCFC)	
		knowledge of secondary system refrigerants such as brine solutions, glycols and inhibitors	
		knowledge of types, grades and applications of oil	
		ability to interpret charts such as charging and pressure temperature charts	
		ability to set up, calibrate and operate charging equipment	
		ability to replenish refrigerants and refrigerant oils	
		ability to confirm charge	
		ability to label system with refrigerant details	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
12.17	Services thermal electric refrigeration systems.	knowledge of types of thermal electric refrigeration systems	tool pouch, electric drill, power saw, ohmmeter, voltmeter, ammeter, multimeter
		knowledge of techniques and procedures to repair and replace components of thermal electric refrigeration systems	
		knowledge of job site load requirements and installation codes	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of electrical ratings, amperages, voltages	
		knowledge of electrical testing equipment such as ammeter, voltmeters, multimeter, ohmmeter and megger	
		ability to interpret blueprints, specifications and electrical codes and symbols	
		ability to set up, calibrate, operate and test instruments	
		ability to verify electrical connections according to company standards	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	no	no	yes	yes	yes	yes	yes	yes	no	NV

Task 13 **Installs mobile systems.**

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
13.01	Removes shipping materials.	knowledge of techniques and procedures for handling mobile systems	tool pouch, utility knife, crow bar
		knowledge of manufacturers' procedures to remove shipping materials	
		knowledge of hoisting and rigging techniques and procedures	
		ability to unload material and/or equipment at assigned location	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to identify and report damages and shortages	
		ability to dispose of waste materials	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

13.02	Verifies mobile system specifications.	knowledge of types of mobile systems	
		knowledge of manufacturers' specifications	
		knowledge of job site load requirements	
		knowledge of electrical ratings, amperages, voltages	
		ability to identify and report damages and/or shortages	
		ability to confirm equipment and materials have been ordered	
		ability to confirm system and equipment corresponds to specified materials on site such as size, capacity, voltage, phase, pressures, fuels, safety certification, standards and codes	
		ability to identify and report damages and shortages	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

13.03	Positions unit by rigging and hoisting.	knowledge of system specifications/work order	hoisting equipment, winch, block and tackle

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of location for mobile system knowledge of hoisting and lifting procedures and devices knowledge of hand signals ability to operate equipment such as a winch, hoist and hydraulic jacks ability to position unit without causing damage	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

13.04	Aligns drive assemblies.	knowledge of hoisting and lifting procedures and devices knowledge of installation procedures for drive assemblies ability to adjust and secure drive assemblies	hoisting equipment, crane, socket set, levels

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

13.05	Connects utilities.	knowledge of techniques and procedures to connect utilities knowledge of types and sizes of piping, hardware and fittings knowledge of piping layout knowledge of power, voltage and phase requirements knowledge of electrical and installation codes	tool pouch, electric drill, electric hammer, power saw, ohmmeter, voltmeter, ammeter, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret blueprints, specifications and electrical codes and symbols	
		ability to attach electric motor or power supply to system	
		ability to verify connections according to company standards and procedures	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
13.06	Connects piping/tubing.	knowledge of built-in and retrofit mobile systems	tool pouch, tube cutters, reamer, bending tools and springs, pipe threaders, torch kit
		knowledge of techniques and procedures to connect piping/tubing	
		knowledge of types and sizes of piping/tubing, couplings and fittings	
		ability to interpret blueprints, schematics, graphs and charts	
		ability to attach couplings and fittings	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
13.07	Connects air distribution systems.	knowledge of types of air distribution systems	tool pouch
		knowledge of techniques and procedures to connect air distribution system	
		ability to interpret manufacturers' specifications, diagrams and charts	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to determine size of duct system for air distribution	
		ability to match self-contained system with air distribution system	
		ability to attach air distribution system to designed location	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	NV

13.08	Connects drain lines.	knowledge of techniques and procedures to connect drains	tube cutters, reamer, pipe threaders, torch kit
		knowledge of types and sizes of piping including attachments and fasteners	
		knowledge of space requirements, mounting methods, specified air flow, adequate water supply, drain facilities, accessibility and piping layout	
		knowledge of brazing and welding techniques and procedures	
		ability to interpret blueprints and specifications	
		ability to estimate type, size and amount of piping	
		ability to cut pipe and make drain connections	
		ability to position drain in accessible location	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
13.09	Hooks up drive system to refrigeration unit.	knowledge of techniques and procedures to hook up drive system to refrigeration unit knowledge of required tolerances for drive systems ability to interpret manufactures' specifications, diagrams and instructions ability to check and align drive systems ability to set up and operate alignment tools	tool pouch, alignment tools

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

13.10	Wires operating controls and safety devices.	knowledge of wiring techniques and procedures knowledge of types, sizes and colour coding of wires knowledge of location of controls and safety devices knowledge of electrical testing equipment such as ammeter, voltmeters, multimeter, ohmmeter and megger ability to interpret manufacturers' specifications, wiring diagrams and schematics ability to set up, calibrate, operate and test instruments	tool pouch, crimper, pullers, ammeter, voltmeter, multimeter, ohmmeter, megger

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to assess amount of wire required to meet connection requirements	
		ability to select wiring to match system specifications	
		ability to measure and cut wires to size	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

13.11	Charges mobile system.	knowledge of methods of charging system	tool pouch, graduated cylinder, pressure gauge, thermometer, weigh scale, oil pump, circulating pump, hygrometer
		knowledge of charging equipment such as graduating cylinder, weigh scale, thermometer and pressure gauges	
		knowledge of types of refrigerants such as ammonia, HFC, CFC and HCFC	
		knowledge of secondary system refrigerants such as brine solutions, glycols and inhibitors	
		knowledge of compatibility of oils and refrigerants	
		ability to replenish refrigerants and refrigerant oils in primary and secondary applications	
		ability to interpret pressure temperature charts	
		ability to confirm charge	
		ability to set up, calibrate and operate charging equipment	

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to label system with refrigerant details	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

Sub-tasks	Enabling Objectives	Tools & Equipment
13.12 Sets up unit.	knowledge of system and its intended application such as minimum ventilation requirements, mixed air temperatures and humidity knowledge of manufacturers' specifications for setting up unit knowledge of system operating parameters ability to interpret manufacturers' specifications, instructions, electric wiring diagrams, schematics and blueprints ability to set up and operate test equipment ability to test operating and safety controls ability to adjust and determine tolerance range for controls	tool pouch, pressure gauge, thermometer, psychrometer, tachometer, velometer, multimeter, ammeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

Task 14 **Diagnoses self-contained system malfunctions.**

Trend: Towards specialized self-contained systems in order to decrease costs.

	Sub-tasks	Enabling Objectives	Tools & Equipment
14.01	Inspects self-contained systems visually and audibly.	knowledge of types of self-contained systems	tool pouch, stethoscope, *psychrometer*
		knowledge of components of self-contained systems such as fan assemblies, drives, pulleys, registers, dampers and diffusers, exhaust hoods, heating and cooling coils, valves and controls	
		knowledge of location of components	
		knowledge of types and sizes of ducting systems and components such as round and square ducts, transition connection duct to fan, balancing valves and turning vanes	
		knowledge of coils for heating and/or cooling such as finned tube, prime tube, steam and refrigerant	
		knowledge of heat transfer for latent and sensible loads	
		ability to interpret psychometric chart to calculate and measure cooling/heating dehumidification load	
		ability to check and calibrate electric, electronic and pneumatic controls	
		ability to measure air, water and steam fans and compare with design	
		ability to check drive assemblies, alignment and balance	
		ability to check electric motors	
		ability to operate testing and measuring instruments	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
14.02	Interprets operating manuals.	knowledge of types of self-contained systems and equipment knowledge of symbols, codes and abbreviations ability to locate information with regard to operation of self-contained systems ability to review electrical diagrams, schematics, charts, fault trees and manufacturers' recommended service manuals ability to identify types of self-contained system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
14.03	Runs on-board diagnostics.	knowledge of diagnostic techniques, procedures and testing devices knowledge of types of self-contained systems and their functions knowledge of trouble-shooting methods for self-contained systems knowledge of operation of on-board diagnostic control devices such as touch pad and control panel ability to interpret original equipment and manufacturers' literature ability to interpret information such as software and input status, wiring continuity and system failure ability to identify and interpret fault codes	computer terminal, printer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret electrical wiring diagrams and schematics	
		ability to visually and physically check system and components to confirm fault code origination	
		ability to operate specialized troubleshooting instruments such as computer, key pad and printer	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

14.04	Checks electrical components.	knowledge of operating procedures for electric/electronic components	tool pouch, voltmeter, multimeter, ammeter, pressure gauge
		knowledge of self-contained system components such as blower fans, humidifiers, cooling coils, valves, controls and electrical connections	
		ability to interpret electrical diagrams, schematics, charts, fault trees and manufacturers' recommended service manuals	
		ability to simulate changing temperatures and pressures and monitor control action	
		ability to check operation of controls and components in a sequential manner to assure designed operation	
		ability to check for loose, worn or frayed electrical connections	
		ability to check electric motors and test electrical components	
		ability to check and calibrate electric, electronic and pneumatic controls	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret test results	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
14.05	Checks operating pressures, temperature and humidity.	knowledge of system design pressure measurements for existing self-contained assemblies knowledge of allowable tolerances for design pressures ability to identify overheating problems and impact on fluid effectiveness ability to adjust valves to meet requirements ability to set up, calibrate and operate test instruments ability to interpret test results	tool pouch, pressure gauge, thermometer, psychrometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
14.06	Checks capacity control system.	knowledge of types of capacity controls used on self-contained systems such as high temperature water control, condenser water control and steam control knowledge of manufacturers' specifications knowledge of test instruments ability to set up test equipment ability to check and calibrate electric, electronic and pneumatic flow	tool pouch, thermometer, voltmeter, milliamp meter, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		controls and the valves actuated by them	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
14.07	Verifies fluid flow.	knowledge of sound, temperature and performance of self-contained system with conventional fluid flows knowledge of flow meters and flow versus pressure drop charts ability to interpret prints, schematics, graphs, charts and tables ability to set up test instruments ability to calibrate flow controls ability to determine fluid flows from sound, temperature and performance of the air handling system	tool pouch, infrared thermometer, flow meter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
14.08	Adjusts controls for products.	knowledge of adjustment techniques and procedures knowledge of locations and types of controls knowledge of product information such as temperature variance knowledge of self-contained system and intended application ability to interpret electrical wiring diagrams and schematics	tool pouch, pressure gauge, thermometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to set up test instruments ability to calibrate and test controls	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
14.09	Determines cause of failure.	knowledge of types of self-contained system and components and intended use knowledge of manufacturers' specifications and operating procedures knowledge of types of potential malfunctions in self-contained systems ability to identify worn, misaligned, corroded and malfunctioning components ability to operate testing and measuring equipment ability to test electrical components and observe loose connections and fittings ability to interpret diagnostic test procedures ability to recognize the need to disconnect and replace system/component/part ability to report cause of failure	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
14.10	Determines repair requirements.	knowledge of work to be performed, length of repair and time required knowledge of manufacturers' specifications knowledge of area of system to be repaired such as electrical, temperature and/or pressure controls knowledge of cost of system components and part availability knowledge of warranty coverage ability to determine if system/component(s) should be repaired or replaced ability to interpret diagnostic test procedures ability to isolate problem to specific area ability to prepare an estimate including list of parts, cost of repair and time required for repair	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
14.11	Determines clean-up procedures.	knowledge of types of refrigerant knowledge of filter drier capacities ability to interpret oil and refrigerant analysis reports ability to change oil/refrigerant	

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to record details on maintenance schedule	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

14.12 Determines warranty status.

knowledge of service and system warranty limits such as time, and degree of reimbursement

knowledge of company policies regarding warranty of self-contained systems and service and use of used accessories/parts

knowledge of general periods of warranty for parts, components and systems

knowledge of extended or specific warranties that apply to self-contained systems or individual components of system

ability to locate and identify accessory, component and system information such as model number, serial number, manufacturer, voltage, phase, size, quantity and capacity

ability to provide reason for part failure or request for warranty such as incorrect size, defective part or broken connections

ability to obtain original invoices and work orders to identify installation date, supplier, manufacturer and terms of warranty

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to discuss system with owner and original equipment supplier	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 15 Overhauls self-contained systems.

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
15.01	Shuts down system.	knowledge of techniques and procedures to shut down self-contained systems knowledge of types of self-contained systems and components knowledge of manufacturers' specifications ability to interpret prints, graphs, charts, schematics and tables ability to identify assemblies and components such as fan assemblies, drives, pulleys, registers, dampers and diffusers, exhaust hoods, heating and cooling coils, valves and controls ability to determine fundamentals of operation of each ability to ensure electrical and energy sources are isolated	tool pouch, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
15.02	Isolates system.	knowledge of techniques and procedures to isolate self-contained systems knowledge of system components knowledge of shut down and start up procedures ability to interpret manufacturers' specifications, charts, tables and schematics ability to adjust or loosen off adjoining parts ability to disengage area of system in order to repair system ability to recognize normal and abnormal operation	tool pouch, pressure gauge, padlock, multimeter, ammeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

15.03	Recovers refrigerant.	knowledge of types of refrigerants and their composition knowledge of techniques and procedures to recover and recycle refrigerants knowledge of safety procedures and precautions when recovering refrigerant ability to set up and operate refrigerant recovery equipment ability to interpret refrigerant management instructions ability to connect retrieval and storage systems	tool pouch, recovery/ recycle unit, manifold pressure gauge, weigh scale, oil pump

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to recover and recycle refrigerants	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

15.04	Disassembles unit.	knowledge of techniques and procedures to disassemble self-contained systems knowledge of types of self-contained systems and components knowledge of manufacturers' specifications knowledge of pipe connections and fittings ability to identify defective components ability to maintain sequential order when disconnecting system components ability to mark components in order to reassemble in sequence	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

15.05	Inspects components electrically.	knowledge of operating procedures for electrical/electronic components knowledge of self-contained system components ability to interpret electrical schematics, charts, fault trees and manufacturers' recommended service manuals	tool pouch, voltmeter, ammeter, multimeter, pressure gauge

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to identify electrical symbols ability to simulate changing temperatures and pressures and monitor control action ability to check electric motors and electrical components for loose, worn or frayed electrical connections ability to interpret test results ability to check and calibrate electric, electronic and pneumatic controls	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
15.06	Inspects components mechanically.	knowledge of types and sizes of self-contained system components knowledge of manufacturers' specifications ability to identify worn, corroded, loose or malfunctioning components ability to check alignment of components ability to lubricate components ability to assess system operation ability to make minor adjustments to mechanical component controls	tool pouch, alignment tools

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
15.07	Performs oil analysis.	knowledge of techniques and procedures to perform oil analysis knowledge of types of self-contained systems knowledge of types, grades and applications of oil ability to interpret manufacturers' specifications, charts, diagrams and tables ability to interpret test results	tool pouch, pressure gauge, test kit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
15.08	Repairs system components.	knowledge of techniques and procedures to repair self-contained system components knowledge of types, sizes, capacities and capabilities of components ability to interpret manufacturers' specifications ability to disassemble system in sequential order ability to adjust component for application ability to replace fastening devices ability to verify that repaired component is operable ability to check intake tubes for damage, cracks, leaks and missing or inoperative components	tool pouch, multimeter, ammeter, pressure gauge, psychrometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to lubricate components	
		ability to check operation of valves	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
15.09	Replaces system components.	knowledge of techniques and procedures to replace system components	tool pouch, alignment tools, multimeter, ammeter, pressure gauge, psychrometer
		knowledge of system and application in which component exists	
		knowledge of types, sizes and capacities of components	
		ability to interpret manufacturers' specifications, diagrams and instructions to assist in replacing defective components	
		ability to disassemble components needing replacement	
		ability to select components to meet system requirements	
		ability to lubricate components	
		ability to select and operate tools	
		ability to verify replacement component is operable	
		ability to adjust component for designed operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
15.10	Adjusts gaskets and door hardware.	knowledge of types of self-contained systems and components knowledge of adjustment techniques and procedures for gaskets and door hardware knowledge of manufacturers' specifications ability to select and operate tools and equipment ability to adjust, align and lubricate components	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
15.11	Replaces gaskets and door hardware.	knowledge of techniques and procedures to replace gaskets and door hardware knowledge of system design and application knowledge of types and sizes of gaskets and door hardware and their distinctive operation ability to interpret manufacturers' specifications, instructions, blueprints and charts ability to select replacement hardware ability to adjust gaskets/door hardware to confirm designed operation	tool pouch, alignment tools, multimeter, ammeter, pressure gauge, thermometer, psychrometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
15.12	Reassembles unit(s).	knowledge of techniques and procedures to assemble self-contained systems knowledge of operation of types of self-contained systems knowledge of types and sizes of components and their function knowledge of electrical and installation codes ability to interpret manufacturers' specification, procedures and instructions ability to connect components and make required adjustment ability to clean, flush, drain, repack and lubricate valves ability to align, attach and secure components to system	tool pouch, electric drill, alignment tools, rigging equipment, hoisting equipment

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
15.13	Evacuates system.	knowledge of manufacturers' procedures, techniques and procedures to evacuate self-contained systems knowledge of safety procedures when evacuating system knowledge of effects of temperature, electrical connections/power interruptions and line sizing on evacuation	tool pouch, vacuum pump, vacuum gauge, compound gauge, micron gauge, manometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to set up and operate equipment	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
15.14	Performs leak test on self-contained systems.	knowledge of leak test methods and safety precautions knowledge of types of refrigerants knowledge of manufacturers' specifications and guidelines ability to select and operate leak detecting equipment ability to interpret test results ability to determine source of leaks	manifold pressure gauge, thermometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
15.15	Charges dry system.	knowledge of techniques and procedures to charge dry system knowledge of government regulations and manufacturers' procedures to charge dry system knowledge of amount of charge required and type of refrigerant ability to operate charging station ability to confirm charge ability to interpret pressure temperature charts	tool pouch, graduated cylinder, pressure gauge, thermometer, weigh scale, oil pump, circulating pump, hygrometer

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to label system with details	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 16 **Installs self-contained systems.**

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
16.01	Removes shipping materials.	knowledge of techniques and procedures for handling self-contained systems	tool pouch, crow bar, utility knife
		knowledge of manufacturers' procedures to remove shipping materials	
		ability to unload material and/or equipment at assigned location	
		ability to identify and report damages and/or shortages	
		ability to dispose of waste materials such as crating, wires and bolts	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

16.02	Verifies specifications.	knowledge of site layout, load requirements and room space requirements	
		knowledge of self-contained system and components	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of electrical ratings, amperages, voltages ability to confirm equipment and materials have been ordered ability to confirm system and equipment corresponds to specified materials on site such as size, capacity, voltage, phase, pressures, fuels, safety certification, standards and codes ability to interpret system specifications and compare with unit nameplate ability to identify and report damages and/or shortages	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

16.03	Positions system by rigging and hoisting.	knowledge of types and sizes of materials and equipment to be lifted knowledge of rigging and hoisting procedures ability to determine weights of objects to be lifted ability to select lifting equipment to match weight of system being lifted ability to identify final location of installation ability to position slings, chains, blocks and mobile equipment ability to connect load line to sling	tool pouch, rigging equipment, hoisting equipment, fork lift

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to direct crane operator using hand signals ability to interpret load capacity chart	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

16.04	Levels self-contained systems.	knowledge of methods for checking system slope using bubble levels and water tube levels knowledge of types and sizes of self-contained systems ability to interpret manufactures' specification, diagrams and instructions ability to align, level and adjust machine level	tool pouch, hoisting equipment, crane, hydraulic jacks, sockets, level

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

16.05	Connects utilities.	knowledge of techniques and procedures to connect utilities knowledge of electrical and installation codes including polarity knowledge of power, voltage and phase requirements knowledge of permits and regulations ability to interpret blueprints, site layout and electrical codes and symbols ability to attach utilities to hardware and piping	tool pouch, voltmeter, ammeter, ohmmeter, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to verify connections according to company standards and manufacturers' specifications	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	NV

16.06	Connects air distribution system.	knowledge of types of air distribution system	tool pouch
		knowledge of techniques and procedures to connect air distribution system	
		ability to interpret manufacturers' specifications, diagrams and charts	
		ability to determine size of duct system for air distribution	
		ability to match self-contained system with air distribution system	
		ability to attach air distribution system to designed location	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	NV

16.07	Connects drain lines.	knowledge of space requirements, mounting methods, humidifier selection, specified air flow, adequate water supply, drain facilities, accessibility, duct layout, piping layout and installation codes	tube cutters, reamer, bending tools, pipe threaders, torch kit
		knowledge of types and sizes of piping including attachments and fasteners	
		knowledge of piping methods and sizing techniques	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of brazing and welding techniques and procedures	
		ability to interpret manufacturers' specifications, blueprints, charts and diagrams	
		ability to estimate type and amount of piping	
		ability to measure, cut and fit pipe	
		ability to make pipe and drain connections	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
16.08	Performs oil analysis.	knowledge of techniques and procedures to perform oil analysis	tool pouch, pressure gauge, test kit
		knowledge of types of self-contained systems	
		knowledge of types, grades and applications of oil	
		ability to interpret manufacturers' specifications, charts, diagrams and tables	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
16.09	Wires operating controls and safety devices.	knowledge of wiring techniques and procedures	tool pouch, crimper, ammeter, voltmeter, multimeter, ohmmeter, megger
		knowledge of types, sizes and colour coding of wires	
		knowledge of location of controls and safety devices	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of electrical testing equipment such as ammeter, voltmeters, multimeter, ohmmeter and megger	
		ability to set up, calibrate, operate and test instruments	
		ability to interpret manufacturers' specifications, wiring diagrams and schematics	
		ability to assess amount of wire required to meet connection requirements	
		ability to select wiring to match system specifications	
		ability to measure and cut wires to size	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
16.10	Charges dry system.	knowledge of techniques and procedures to charge dry system	tool pouch
		knowledge of types of self-contained systems	
		knowledge of types, grades and applications of oil	
		ability to interpret manufacturers' specifications, charts, diagrams and tables	
		ability to verify system operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
16.11	Starts up self-contained system.	knowledge of start up procedures for self-contained systems knowledge of types of test instruments such as multimeter and pressure gauges knowledge of system operating parameters and specifications ability to interpret gauges and meters to confirm operation is within specifications ability to recognize anomalies in start up through visual and auditory inspection	tool pouch, pressure gauge, multimeter, ammeter, thermometer, psychrometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 17 Commissions refrigeration systems.

Trend: Towards the collection of more monitored data, manufacturers' specifications and greater documentation requirements. Towards the increased use of energy efficient systems.

	Sub-tasks	Enabling Objectives	Tools & Equipment
17.01	Reviews manufacturers' specifications for commissioning refrigeration systems.	knowledge of complete system and its intended application as well as its operation and component location ability to interpret manufacturers' specifications, diagrams blueprints and shop drawings ability to comply with instructions and procedures so that all tasks are preformed in sequential order	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret electrical wiring diagrams and schematics	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

17.02	Checks utility sources.	knowledge of test instruments such as multimeter, voltmeter, ammeter, pressure gauges	tool pouch, multimeter, voltmeter, ammeter, pressure gauge
		knowledge of sizes and types of wire as per code	
		knowledge of code requirements and operating specifications for utilities	
		knowledge of types of utilities such as gas, water, steam heat, oil and propane	
		ability to set up, calibrate and operate test equipment	
		ability to interpret blueprints and specifications	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

17.03	Checks phase rotation.	knowledge of test instruments such as phase meter and ammeter	phase meter, ammeter, multimeter
		knowledge of impact of phase reversal on refrigeration system	
		knowledge of damage to components such as air movement, oil pressure and water movement	
		ability to identify direction of rotation of components such as fans, pumps, compressors, motors	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to reverse rotation of components	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
17.04	Checks crankcase heater.	knowledge of test equipment such as ohmmeters, ammeters, multimeter, voltmeters, thermometers and infrared thermometers	ohmmeter, ammeter, multimeter, voltmeter, thermometer, infrared thermometer
		knowledge of purpose and location of heaters	
		knowledge of temperature parameters and specifications	
		ability to set up, calibrate and operate test equipment	
		ability to adjust temperatures	
		ability to measure temperatures	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
17.05	Checks wiring.	knowledge of types and sizes of wires	ammeter, voltmeter, multimeter, ohmmeter, megger
		knowledge of electrical test equipment such as ammeter, voltmeter, multimeter, ohmmeter and megger	
		knowledge of wiring defects such as shorts, grounds and opens	
		ability to set up, calibrate, operate and test instruments	
		ability to interpret schematics to verify wiring	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to identify loose, damaged, worn, discoloured and missing wires	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
17.06	Meggers motor.	knowledge of test instruments such as meggers knowledge of manufacturers' specifications for motors such as resistance to ground and between phases knowledge of conditions for meggering motors such as temperature, humidity, pressure and the impact of those conditions on the process ability to set up and operate meggers ability to identify lower resistance	tool pouch, megger

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
17.07	Checks positions of isolation valves.	knowledge of instruments such as pressure gauges knowledge of types and location of valves such as shut off and service valves knowledge of system operation for positioning valves during start up ability to interpret piping drawings ability to interpret readings in order to determine valve position	tool pouch, pressure gauge

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to visually identify open and closed valves	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

17.08	Sets-up valve operation.	knowledge of types of valves such as check, regulating, control modulating, solenoid and metering knowledge of location of valves and valve positioners knowledge of temperature pressure charts knowledge of electrical, hydraulic, pneumatic and electronic control valves knowledge of application requirements of valves ability to adjust valves ability to set up, calibrate and set up test equipment ability to interpret readings	tool pouch, pressure gauge, thermometer, voltmeter, potentiometer, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

17.09	Charges system.	knowledge of methods of charging system such as sight glass, superheat method, charging chart, liquid level, sub-cooling, cross line and weight knowledge of charging equipment such as graduating cylinder, weigh scale, thermometer and pressure gauge	tool pouch, graduated cylinder, pressure gauge, weigh scale, thermometer, oil pump, circulating pump, hydrometer, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types of refrigerants such as ammonia, HFC, CFC and HCFC	
		knowledge of secondary system refrigerants such as brine solutions, glycols and inhibitors	
		knowledge of types, grades and applications of oil	
		ability to replenish refrigerants and refrigerant oils in primary and secondary applications	
		ability to confirm charge	
		ability to interpret pressure temperature charts	
		ability to set up, calibrate and operate charging equipment	
		ability to label system with refrigerant details	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

17.10	Starts up system.	knowledge of start up procedures	tool pouch, pressure gauge, multimeter, ammeter, thermometer, psychrometer
		knowledge of types of test instruments such as multimeter and pressure gauges	
		knowledge of system operating parameters and specifications	
		ability to interpret gauges and meters to confirm operation is within specifications	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to recognize anomalies in start up through visual and auditory inspection	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
17.11	Checks operating temperatures, pressures and humidity.	knowledge of system humidity, pressure and temperature requirements knowledge of test instruments such as pressure gauge, psychrometer and pressure regulator knowledge of valve types such as thermostatic expansion valves, hot gas bypass, automatic expansion valves, capacitor, pressure regulator, crank case pressure regulating and back up pressure regulating ability to adjust valves to meet requirements ability to set up, calibrate and operate test instruments	tool pouch, pressure gauge, thermometer, psychrometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
17.12	Sets superheats.	knowledge of system and its intended application in regard to required refrigerant, humidity, pressure and temperature knowledge of types of refrigerants such as ammonia, HFC, CFC and HCFC	tool pouch, manifold pressure gauge, thermometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of metering devices and the required adjustment procedures to change superheat	
		ability to interpret pressure temperature charts to calculate superheats	
		ability to adjust metering devices	
		ability to set up and operate test instruments	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
17.13	Balances water flow for refrigeration systems.	knowledge of types and sizes of refrigeration systems	tool pouch, pressure gauge, thermometer
		knowledge of techniques and procedures to balance water flow	
		knowledge of valves such as water regulating, balancing, solenoid and check valves	
		ability to interpret manufacturers' specifications, diagrams and instructions	
		ability to adjust valves for water flow	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
17.14	Checks sub-cooling.	knowledge of system and its intended application in regard to sub-cooling	tool pouch, thermometer, manifold pressure gauge
		knowledge of techniques and procedures to check sub-cooling	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret manufacturers' specifications, diagrams and schematics in regard to recommended sub-cooling ability to set up and operate test instruments and pressure gauges ability to measure sub-cooling	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
17.15	Sets-up operating and safety controls.	knowledge of system and its intended application in regard to humidity, pressure and temperature requirements knowledge of system operating perimeters knowledge of existing type and location of operating and safety controls knowledge of operating or safety control tolerance ranges knowledge of purpose and function of electrical, electronic and pneumatic refrigeration controls and control circuitry ability to interpret manufacturers' specifications, electrical wiring diagrams, blueprints and instructions for set up and testing of operating and safety controls ability to set up and operate test instruments such as pressure gauges, multimeters and ammeters	tool pouch, manifold pressure gauge, thermometer, psychrometer, tachometer, velometer, multimeter, ammeter, pressure gauge

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to adjust operating and safety controls ability to determines tolerance range for system controls ability to test operating and safety controls	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
17.16	Sets-up heat reclaim/ recovery system.	knowledge of types of heat recovery systems such as heating of water and heating of air knowledge of safety and operating controls and associated devices required to operate heat recovery systems such as valves, relief devices, thermostats, solenoids and pressure temperature controls knowledge of economic advantages of using heat reclaim system knowledge of existing system and its intended application in regard to limitation and supplemental requirements knowledge of the primary heating device ability to interpret manufacturers' specifications, diagrams and instructions in regard to the set up and check out of heat reclaim systems ability to set up and operate test instruments and pressure gauges	tool pouch, pressure gauge, thermometer, psychrometer, multimeter, ammeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
17.17	Verifies operation of purge unit system.	knowledge of system and its intended application in regard to refrigerant and type of purge unit knowledge of centrifugal compressor assembly knowledge of problems associated with non-condensibles in a centrifugal system knowledge of types of purge units such as manual, automatic and compressor operated ability to interpret manufacturers' specifications, diagrams and instructions regarding to operational check and maintenance requirements to purge unit ability to set up and operate test instruments	tool pouch, pressure gauge, thermometer, multimeter, ammeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	no	yes	yes	yes	yes	no	yes	yes	yes	NV

17.18	Checks defrost for refrigeration.	knowledge of existing system and its intended application in regard to system refrigerants, required temperature, humidity and type of defrost knowledge of types of defrost systems such as condensing unit, electric defrost, hot gas defrost reverse cycle and air defrost knowledge of operating and safety controls associated with defrost system knowledge of advantages and disadvantages of defrost systems	tool pouch, pressure gauge, thermometer, multimeter, ammeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret manufacturers' specifications, diagrams and instructions in regard to set up and check out of defrost system ability to interpret electrical wiring diagrams, schematics and blueprints ability to set up and operate test instruments and pressure gauges	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
17.19	Checks fluid levels.	knowledge of existing system and its intended application in regard to type of refrigerant, oil, water and required levels ability to interpret manufacturers' specifications, diagrams and instructions in regard to system requirements and techniques to check fluid levels ability to visually inspect and interpret devices such as sight glasses, receiver gauge and dip sticks	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
17.20	Checks voltage and amperage.	knowledge of component rated voltage and currents knowledge of component allowable tolerances for voltage and currents knowledge of allowable voltage and current unbalance	tool pouch, multimeter, ammeter, voltmeter, ohmmeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to set up and operate test instruments ability to calculate voltage and current unbalance	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

17.21	Checks motor drives.	knowledge of existing system and its intended application with regard to type and set up of motor drives knowledge of types of drives such as belt and direct knowledge of required tolerances for belt and direct drive systems ability to interpret manufacturers' specifications, diagrams and instructions in regard to set up and check of motor drives ability to check and align drives ability to calculate system component speeds ability to measure speed of system component ability to set up and operate alignment tools	tool pouch, tachometer, calculator, alignment tools, multimeter, ammeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

17.22	Checks remote and in-house alarms.	knowledge of existing system and its intended application	tool pouch, multimeter, ammeter, pressure gauge, thermometer,

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret manufacturers' specifications and instructions in regard to set up and checkout of alarm systems	psychrometer, computer terminal, printer
		ability to interpret electrical wiring diagrams and schematics	
		ability to interpret source/cause of types of system alarms	
		ability to determine the output or indication of types of alarms	
		ability to visually or audibly confirm indication of types of alarms	
		ability to test and reset each alarm and confirm operation	
		ability to set up and operate test instruments	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
17.23	Labels equipment.	knowledge of system and labelling requirements	labelling machine
		knowledge of positioning of labels	
		ability to clean area before installation	
		ability to position labels in designated area of system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
17.24	Completes start up report.	knowledge of information contained on start up report	

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of system start up procedures and sequences	
	knowledge of manufacturers' recommended instructions on completion process	
	ability to document start up information such as date, time, identification number and status of system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

17.25	Completes warranty cards.	knowledge of completion requirements for warranty cards	
		knowledge of service and system warranty limits such as time, and degree of reimbursement	
		knowledge of company policies regarding warranty of refrigeration systems and service and use of used accessories/parts	
		knowledge of general periods of warranty for parts, components and systems	
		knowledge of extended or specific warranties that apply to refrigeration systems or individual components of systems	
		ability to obtain original invoices and purchase orders to identify information such as installation dates, suppliers, model number, serial number and manufacturer	
		ability to contact manufacturer for warranty status requirements such as	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		part return information and warranty cards ability to record information on warranty card(s)	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

17.26	Instructs customer on system operation.	knowledge of complete system operation in all modes of operation and ability to explain to customer knowledge of the location and identification of components within system ability to explain location and features to customer ability to explain operation of system to customer including system shut down and start up ability to instruct customer on alarm indication and cause of action to be taken when an alarm exists ability to provide customer with necessary information such as system documentation, warranties, contact person and phone numbers	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

BLOCK D AIR CONDITIONING SYSTEMS

Task 18 **Designs air conditioning systems.**

Trend: Towards the use of more energy efficient systems.

	Sub-tasks	Enabling Objectives	Tools & Equipment
18.01	Interprets set of building drawings.	knowledge of types and capacities of air conditioning systems knowledge of types of drawings such as architectural, structural and mechanical knowledge of symbols used for layout of devices, location and routing of wiring and special notes ability to analyze drawings to determine location and areas of coverage ability to identify missing elements in order to determine efficiency of the design ability to scrutinize complete set of drawings for design and installation of system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

18.02	Interprets psychrometric charts.	knowledge of types, capacities and composition of air conditioning systems knowledge of properties of air in relation to operation of air conditioning systems such as	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		composition of air, water vapour in air and measurement of relative humidity	
		knowledge of air conditioning terms, symbols and units of measurement for wet-bulb and dry-bulb temperature, dew point temperature, specific and relative humidity, enthalpy, specific volume, gains of moisture and barometric pressure	
		ability to identify and interpret data on psychometric charts	
		ability to plot specific conditions obtained on psychometric charts	
		ability to identify air conditioning process on psychometric chart	
		ability to interpret changes that occur in condition of air as it passes through system, such as mixtures of air quantities, heating and cooling without changing moisture content, heating with humidification, cooling with constant enthalpy, cooling with dehumidification, cooling with humidification, by-pass factors, sensible heat process and factors, and apparatus dew point	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

18.03	Establishes requirements for air conditioning system.	knowledge of intended site, air conditioning expectations such as location, space capacity, environment and intended application	
		knowledge of types, capacities and operation of air conditioning systems	

Sub-tasks	Enabling Objectives	Tools & Equipment
	and assemblies such as heating, air handling and distribution, humidifiers, ventilation and air exchange systems	
	knowledge of practices and principles applicable in conditioned space control	
	ability to interpret effect of temperature, humidity and air motion on human comfort such as heat transfer from human body, effect of air motion on comfort, effect of radiation, conduction and convection of heat on conditioned space	
	ability to identify types of components of air conditioning systems and how these components operate within system	
	ability to identify how and where air conditioning systems are used in industrial and commercial applications	
	ability to establish classifications for air conditioning equipment such as comfort air conditioning, industrial air conditioning, winter, summer, year-round and computer room systems	
	ability to identify variations of air conditioning systems such as ventilating system, packaged system, heat pump, split system and central station system	
	ability to describe applications of air conditioning systems such as advantages, disadvantages, piping and duct work arrangements for single and multi-zone units, induction	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		systems, pre-heat system and re-heat system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

18.04	Calculates load requirements for air conditioning system.	knowledge of sizes and capacities of air conditioning systems including designed load requirements ability to interpret manuals and charts in order to estimate heat loss and heat gain ability to interpret drawings and charts in order to conduct load analysis	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	NV

18.05	Selects air conditioning equipment, piping and accessories.	knowledge of types and capacities of air conditioning units knowledge of types, sizes and amount of equipment, piping and accessories knowledge of system requirements and available space knowledge of types of humidifying and dehumidifying equipment such as spray, wetted surface and evaporative ability to determine British thermal unit (BTU) requirements for cooling, heating and ventilation	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to verify return and outside air circulation requirements	
		ability to determine size and type of duct system based upon static pressure, total pressure, inches of water column and air distribution	
		ability to select registers, grilles and diffusers and determine placement of volume(s) and splitter dampers	
		ability to determine types of filters such as viscous, dry and electronic	
		ability to identify location of filter bank(s)	
		ability to determine micron efficiency	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	NV

18.06	Selects air conditioning control systems.	knowledge of types of control systems such as pneumatic, electric, electronic and fluidic	
		knowledge of types and capacities of air conditioning units	
		knowledge of function tests for vacuum, electric, manual and mechanical control systems	
		ability to interpret manufacturers' specifications, tables and charts	
		ability to match controls with type of component/assembly as determined for load such as air circulation ventilation system, air cooling system, air heating system, air cleaning equipment, air distribution,	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		humidifying, dehumidifying and automatic control system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
18.07	Selects ducting for air conditioning system.	knowledge of types of air conditioning systems ability to interpret manufacturers' specifications and/or blueprints for position and location of ducting ability to determine type and size of duct system based upon air distribution, static pressure, total pressure and inches of water column ability to select ducting to correspond with registers, grilles and diffusers **(NOT COMMON CORE)**	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	no	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
18.08	Determines equipment layout.	knowledge of site location, space requirements and system specifications knowledge of equipment positioning based on system requirements and available space knowledge of types and capacities of air conditioning units ability to interpret blueprints and schematics	

Sub-tasks Enabling Objectives Tools & Equipment

ability to position equipment according to customer's instructions and/or system specifications

ability to estimate additional space for accessories

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

18.09 Prepares drawings and sketches.

knowledge of types, sizes and capacities of air conditioning systems

knowledge of drafting techniques and procedures

knowledge of symbols used for layout of devices,
location of ducting, routing of piping and special notes

ability to draw/sketch the area of installation showing layout of system including ducting, piping and control systems

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	NV

18.10 Determines job parameters.

knowledge of job costing techniques, including equipment and labour costs

knowledge of manufacturer and company price list and pricing policy

ability to estimate cost of refrigeration system, parts, material and labour

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to estimate time frames	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
18.11	Prepares estimate.	knowledge of information contained on estimate knowledge of company and manufacturers' warranty policies knowledge of company policies and procedures knowledge of cost of materials, equipment and accessories including mark-ups ability to assess work performed by outside utilities, including costs and time frames ability to determine installation and labour costs	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
18.12	Submits drawings for approval.	knowledge of information contained on drawings such as system, piping and duct layout, routing of wiring, electrical and mechanical symbols and special notes knowledge of drawings, codes and specifications ability to identify missing elements from the drawings	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	NV

Task 19 Diagnoses air handling system malfunctions.

Trend: Towards the greater use of multi-zone air handling systems.

	Sub-tasks	Enabling Objectives	Tools & Equipment
19.01	Inspects air handling system.	knowledge of types of air handling and distribution units such as single zone, multi-zone, air induction, water induction and conventional knowledge of components of air handling and distribution units such as blower fan assembly, duct system, registers, grilles, dampers and diffusers, humidifier and dehumidifier assemblies, air cleaning assemblies, exhaust hoods, mixing chamber, heating and cooling coils and controls knowledge of types of fans such as vane axial, centrifugal backward inclined and centrifugal forward curved and their operating parameters knowledge of drive systems such as belt drive, variable speed pulleys and direct drive fans knowledge of bearings such as needle, ball and roller bearing knowledge of types and styles of ducting systems such as round, square, transition connections duct to fan, balancing valves, turning vanes knowledge of coils for heating and/or cooling such as finned tube, prime tube, for both hot water and cold water as well as steam and refrigerant knowledge of heat transfer for latent and sensible loads	tool pouch, manometer, velometer, electronic balancing tools, vibration analysis equipment, straight edge, voltmeter, ammeter, megger, thermometers, psychrometer, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of heating, ventilating and air conditioning controls	
		ability to interpret psychometric chart to calculate and measure cooling/ heating dehumidification loads	
		ability to measure air, water and steam fans and compare with design	
		ability to inspect air handling system for play, looseness/balance	
		ability to check drive assemblies, alignment and balance	
		ability to operate testing and measuring instruments	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

19.02	Checks functionality and output of electrical components.	knowledge of operating procedures for electrical/electronic components	tool pouch, voltmeter, ammeter, multimeter
		knowledge of air handling system components such as blower fans, diffusers, humidifiers, heating and cooling coils, controls and electrical wiring	
		ability to interpret electrical schematics, charts, fault trees and manufacturers' recommended service manuals	
		ability to identify electrical symbols	
		ability to simulate changing temperatures and pressures and monitor control action	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to check for loose, worn or frayed electrical wires and connections	
		ability to check electric motors and test electrical components	
		ability to interpret test results	
		ability to check and calibrate electric, electronic and pneumatic controls	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
19.03	Checks operating static pressure, temperature and humidity.	knowledge of operation of air handling system including static pressures, temperatures and humidity	tool pouch, manometer, magnehelic gauge, thermometer, pressure gauge, psychrometer
		knowledge of equipment manufacturers' operation and maintenance manuals	
		ability to measure pressures, temperatures and humidity and compare with design of air handling system	
		ability to locate faults such as fluctuations in temperature, pressure or humidity and overheating problems	
		ability to interpret test results	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
19.04	Checks capacity controls.	knowledge of types of capacity controls used on air handling systems	tool pouch, pressure gauge, multimeter, ammeter, thermometer,

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types of thermostats	voltmeter, manometer, milliamp meter
		ability to interpret electrical wiring diagrams and charts	
		ability to verify that valve and nozzle sizes meet system specifications	
		ability to check and calibrate electric, electronic and pneumatic flow controls and the valves actuated by them	
		ability to set up, calibrate and operate test equipment such as high and low limit, flame fallout, flame proving, air proving and safety lock out	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
19.05	Verifies flow of fluids.	knowledge of existing system and its intended application	tool pouch, infrared thermometer, flow meter
		knowledge of sound, temperature and performance of air handling system with normal fluid flows	
		knowledge of types of flow measuring devices such as flow meters and flow versus pressure drop charts	
		ability to interpret prints, schematics, graphs, charts and tables	
		ability to set up, calibrate and operate fluid flow instruments	
		ability to check pressure difference to confirm flow	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to isolate blockages by temperature of lines	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
19.06	Verifies flow across coils.	knowledge of existing system and its intended application knowledge of sound, temperature and amount of fluid flow across coils under normal operating conditions ability to interpret manufacturers' specifications, tables and charts ability to manually check flow across coils ability to isolate blockages or restrictions ability to check pressures	flow meter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
19.07	Measures air velocity.	knowledge of air handling system components such as filters, coils, dampers and linkages knowledge of system operation and design features ability to interpret manufacturers' specifications for air velocity measurements ability to select and operate test instruments ability to interpret test results	flow meter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to measure velocity and compare with manufacturers' specifications	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

19.08	Measures air pressure drop across coils.	knowledge of air handling system components such as filters, coils, dampers and linkages knowledge of system operation and design features ability to interpret manufacturers' specifications for air pressure ability to select and operate test instruments ability to interpret test results ability to measure air pressure and compare with system design	pressure gauge, manometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

19.09	Conducts electrical test.	knowledge of manufacturers' specifications and operating procedures for air handling systems knowledge of types of potential malfunctions in air handling systems ability to interpret diagrams, charts and schematics ability to test electrical components ability to adjust electrical controls	ammeter, voltmeter, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to observe loose connections and fittings ability to isolate problem to specific area/component ability to report cause of failure	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

19.10	Determines cause of failure.	knowledge of air handling system components such as blower fan assembly, duct system, registers, grilles, dampers, diffusers, humidifier, dehumidifier assemblies, air cleaning assemblies, exhaust hoods, mixing chamber, heating and cooling coils and controls knowledge of manufacturers' specifications and operating procedures knowledge of types of potential malfunctions in air handling systems ability to interpret diagrams, charts, schematics and diagnostic test procedures ability to identify worn, misaligned, corroded and malfunctioning components ability to operate testing and measuring equipment ability to observe loose connections and fittings ability to isolate problem to specific area/component	tool pouch, voltmeter, manifold pressure gauge, ohmmeter, multimeter, micrometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to report cause of failure	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
19.11	Determines repair requirements.	knowledge of work to be performed, length of repair and time required	
		knowledge of area of system to be repaired such as electrical, mechanical, temperature controls and pressure controls	
		knowledge of cost of system components and part availability	
		knowledge of manufacturers' specifications and warranty coverage	
		ability to isolate problem to specific area	
		ability to determine if components should be repaired or replaced	
		ability to interpret diagnostic test procedures	
		ability to prepare an estimate including list of parts, cost of repair and time required for repair	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
19.12	Determines warranty status.	knowledge of service and system warranty limits such as time, and degree of reimbursement	
		knowledge of company policies regarding warranty of air handling	

Sub-tasks	Enabling Objectives	Tools & Equipment
	systems and service and use of used accessories/parts	
	knowledge of general periods of warranty for parts, components and systems	
	knowledge of extended or specific warranties that apply to air handling system or individual components of system	
	ability to locate and identify accessory, component and system information such as model number, serial number, manufacturer, voltage, phase, size, quantity and capacity	
	ability to provide reason for part failure or request for warranty such as incorrect size, defective part or broken connections	
	ability to obtain original invoices and work orders to identify installation date, supplier, manufacturer and terms of warranty	
	ability to discuss system with owner and original equipment supplier	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 20 **Overhauls air handling systems.**

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
20.01	Shuts down system including lock out.	knowledge of techniques and procedures to shut down and lock out air handling systems knowledge of types of air handling systems such as single zone, multi-zone, air induction, water induction and conventional knowledge of manufacturers' specifications ability to interpret prints, diagrams, charts and schematics ability to identify assemblies and components and determine fundamentals of operation of each ability to ensure electrical and energy sources are isolated	tool pouch, padlock, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

20.02	Isolates air handling system.	knowledge of techniques and procedures to isolate air handling systems knowledge of system components such as blower fan assembly, duct system, registers, grilles, dampers, diffusers, humidifier, dehumidifier assemblies, air cleaning assemblies, exhaust hoods, mixing chamber, heating and cooling coils and controls knowledge of shut down and start up procedures ability to interpret manufacturers' specifications, prints, schematics and charts	tool pouch, pressure gauge, padlock, multimeter, ammeter

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to adjust or loosen off adjoining parts ability to disengage area of system in order to repair system ability to recognize normal and abnormal operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Sub-tasks	Enabling Objectives	Tools & Equipment
20.03 Recovers refrigerant.	knowledge of types of refrigerants and their composition knowledge of techniques and procedures to recover and recycle refrigerants knowledge of safety procedures and precautions when recovering refrigerant ability to operate refrigerant recovery equipment ability to interpret refrigerant management instructions ability to change oil and filter driers ability to recover and recycle refrigerants	tool pouch, hoses, pressure regulators, recovery/recycle unit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Sub-tasks	Enabling Objectives	Tools & Equipment
20.04 Drains fluids.	knowledge of techniques and procedures to drain fluids knowledge of types of fluids	tool pouch, funnel, hoses, recovery/recycle unit

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of safety procedures when handling fluids	
		knowledge of location and method for disposing and recycling fluids	
		knowledge of recycling requirements and equipment for fluids	
		ability to interpret manufacturers' specifications, charts and diagrams	
		ability to visually inspect fluids for contamination	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

20.05	Disassembles air handling system.	knowledge of techniques and procedures to disassemble air handling system	tool pouch, bolt cutter, rigging equipment, hoisting equipment, come-along, slings
		knowledge of types of air handling systems components such as blower fan assembly, duct system, registers, grilles, dampers, diffusers, humidifier, dehumidifier assemblies, air cleaning assemblies, exhaust hoods, mixing chamber, heating and cooling coils and controls	
		knowledge of manufacturers' specifications	
		knowledge of pipe connections and fittings	
		ability to identify defective components	
		ability to operate rigging and hoisting equipment	

Sub-tasks		Enabling Objectives	Tools & Equipment
		ability to select and operate tools and equipment	
		ability to maintain sequential order when disassembling air handling system components	
		ability to mark components in order to reassemble in sequence	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

20.06	Inspects air handling mechanical components.	knowledge of types and sizes of air handling system components and history of malfunctions	tool pouch
		knowledge of manufacturers' specifications	
		ability to identify worn, corroded, loose or malfunctioning components for source of problem	
		ability to check alignment of components	
		ability to make minor adjustments to mechanical component controls	
		ability to lubricate components	
		ability to assess system operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

20.07	Selects replacement components.	knowledge of fundamentals of operation and design of air handling systems	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types and sizes of air handling system components such as blower fan assembly, duct system, registers, grilles, dampers, diffusers, humidifier, dehumidifier assemblies, air cleaning assemblies, exhaust hoods, mixing chamber, heating and cooling coils and controls	
		knowledge of electrical and installation codes	
		knowledge of manufacturers' specifications and suggested replacement components	
		knowledge of equipment capacity and compatibility	
		ability to interpret manufacturers' specification, diagrams and instructions to assist in the identification of parts and components	
		ability to identify system/component information such as manufacturer, model number, serial number, size, capacity, voltage, phase and quantity	
		ability to determine if component repair or replacement is feasible	
		ability to match component to type of system/assembly	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

20.08	Repairs dampers and linkages.	knowledge of techniques and procedures to repair dampers and linkages	tool pouch

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types and sizes of dampers and linkages ability to interpret manufacturers' specifications and repair recommendations ability to replace fastening devices ability to make adjustments to dampers and linkages ability to verify operation of system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

20.09	Replaces components.	knowledge of techniques and procedures to replace components knowledge of types, sizes and operation of components such as bearings, fans, motors, coils, belts and drive assemblies ability to interpret manufacturers' specifications, blueprints, schematics and charts ability to replace bearings in fans or blower assemblies ability to adjust, align, level and lubricate components ability to select replacement part to match component and system ability to operate test instruments and interpret results	tool pouch, multimeter, pressure gauge, flow meter, alignment tools

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to verify operation of system/component	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
20.10	Reassembles air handling system.	knowledge of techniques and procedures to assemble air handling systems knowledge of operation and types of features of air handling systems knowledge of types and sizes of components and their function knowledge of electrical and installation codes ability to interpret and follow manufacturers' specifications, procedures and adjustment operations ability to connect components and make required adjustment ability to clean, flush, drain, repack and lubricate valves ability to align, attach and secure components to system ability to operate tools and equipment	tool pouch, alignment tools, level, electric drill, alignment tools, rigging equipment, hoisting equipment

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
20.11	Performs leak test on system.	knowledge of techniques and procedures to perform leak test on air handling systems	tool pouch, manifold pressure gauge, leak detectors, thermometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types of leak test methods such as halide torch, electronic, ultrasonic and soap solution	
		knowledge of types of refrigerants	
		knowledge of manufacturers' specifications, guidelines and safety precautions	
		ability to select, set up and operate leak detecting equipment	
		ability to inspect gaskets and seals	
		ability to interpret test results	
		ability to determine source of leaks	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 21 **Installs air handling systems.**

Trend: Towards more rigid installation standards.

	Sub-tasks	Enabling Objectives	Tools & Equipment
21.01	Removes shipping materials.	knowledge of manufacturers' procedures to remove shipping materials	tool pouch, crow bars, utility knife
		knowledge of techniques and procedures for handling air handling systems	
		knowledge of hoisting and rigging techniques and procedures	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to unload material and/or equipment at assigned location	
		ability to identify and report damages and/or shortages	
		ability to dispose of waste materials such as crating, wood, wires, bolts and paper	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
21.02	Verifies air handling system specifications.	knowledge of air handling systems such as single zone, multi-zone, air induction, water induction and conventional	
		knowledge of air handling system components such as blower fan assembly, duct system, registers, grilles, dampers, diffusers, humidifier and dehumidifier assemblies, air cleaning assemblies, exhaust hoods, mixing changer, heating and cooling coils and controls	
		knowledge of energy sources such as steam, hot water, oil and gas	
		knowledge of job site load requirements, electrical ratings, amperages and voltages	
		ability to interpret system specifications and compare with unit nameplate	
		ability to identify and report damages and/or shortages	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
21.03	Mounts control valves.	knowledge of types, sizes and capacities of control valves knowledge of techniques and procedures to mount control valves knowledge of layout, location of system and space requirements knowledge of wiring design and piping layout knowledge of installation codes ability to identify and select control valves according to manufacturers' specifications, application diagrams, plans and shop drawings ability to braze, solder and weld ability to position control valves in accessible location for operation	tool pouch, electric drill, pipe threaders, flaring tools, tube cutters, torch kit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	NV

21.04	Aligns air handling systems.	knowledge of techniques and procedures to align air handling systems knowledge of manufacturers' specifications ability to position system allowing space for connections ability to adjust system controls and valves	alignment tools, pressure gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
21.05	Connects power supply, including fans.	knowledge of electrical and installation codes including polarity knowledge of techniques and procedures to connect power supply knowledge of power, voltage and phase requirements knowledge of permits and regulations ability to interpret blueprints, building layout and electrical codes and symbols ability to attach utilities to hardware and piping ability to install fans ability to verify connections according to company standards and manufacturers' specifications	tool pouch, ammeter, voltmeter, ohmmeter, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	yes	no	yes	no	NV

21.06	Connects pipe(s)/tubing, including couplings and fittings.	knowledge of techniques and procedures to connect piping/tubing knowledge of system layout knowledge of types and sizes of piping/tubing, couplings and fittings ability to interpret blueprints, schematics, graphs and charts ability to braze and weld ability to attach couplings and fittings	tool pouch, torch kit, nitrogen cylinder and regulator, tube cutter, reamer, pressure gauge

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to select and operate tools and test instruments	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	NV

21.07	Checks piping/tubing connections, including couplings and fittings.	knowledge of piping/tubing connection techniques and procedures knowledge of piping/tubing diagrams including codes and symbols ability to interpret blueprints, diagrams, schematics and specifications ability to assess connection state and check for defects/damage ability to adjust connections including couplings and fittings ability to identify replacement needs	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	NV

21.08	Evacuates non-condensibles from system.	knowledge of manufacturers' procedures to evacuate non-condensibles from system knowledge of safety procedures when evacuating system knowledge of required vacuum readings and durations knowledge of effects of temperature, electrical connections/power interruptions and line sizing on evacuation	tool pouch, vacuum pump, vacuum gauge, compound gauge, micron gauge, manometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret vacuum gauges to ensure evacuation and absence of any leaks and moisture	
		ability to replace vacuum pump oil	
		ability to set up and operate pressure and micron gauges and vacuum pumps	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	yes	yes	yes	no	NV

21.09	Performs leak test on system.	knowledge of techniques and procedures to perform leak test on air handling system	tool pouch, manifold pressure gauge, leak detector, thermometer
		knowledge of types of leak test methods such as halide torch, electronic, ultrasonic and soap solution	
		knowledge of types of refrigerants	
		knowledge of manufacturers' specifications, guidelines and safety precautions	
		ability to select and operate leak detecting equipment	
		ability to interpret test results	
		ability to determine source of leaks	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	yes	yes	yes	no	NV

Task 22 **Diagnoses heating system malfunctions.**

Trend: Towards the development and use of more energy efficient designs and electronic controls. Towards increased diagnostic circuitry built into systems in order to pinpoint problems without randomly replacing parts.

	Sub-tasks	Enabling Objectives	Tools & Equipment
22.01	Inspects heating systems.	knowledge of types of heating systems such as high/low fired oil systems, propane/natural gas systems, multiple stage heaters and SCR controlled heating systems knowledge of principles of operation and parameters of performance of heating systems knowledge of electric, electronic and pneumatic controls knowledge of energy sources such as steam, hot water and direct fired ability to visually check system and components for corrosion, fouling and damage ability to check valve operation ability to check operation of safety devices	tool pouch, thermometer, goggles, rubber gloves, rubber boots

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

22.02	Runs on-board diagnostics.	knowledge of diagnostic techniques, procedures and testing devices knowledge of types of heating systems and their functions knowledge of trouble-shooting methods for heating systems	computer terminal, printer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of operation of on-board diagnostic control devices such as touch pad and control panel ability to interpret original equipment and manufacturers' literature ability to interpret information such as software and input status, wiring continuity and system failure ability to identify and interpret fault codes ability to obtain and interpret manufacturers' diagrams, specifications and instructions to aid in troubleshooting diagnoses ability to interpret electrical wiring diagrams and schematics ability to visually and physically check system and components to confirm fault code origination ability to operate specialized troubleshooting instruments such as computer, key pad and printer	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
22.03	Checks functionality and output of electrical components.	knowledge of operating procedures for electric/electronic components including controls knowledge of types of system components and assemblies such as blower fans, diffusers, humidifiers, heating and cooling coils, controls and electrical wiring	tool pouch, voltmeter, multimeter, ammeter, pressure gauge, CO_2 analyzer, combustion analyzers

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of trouble-shooting techniques for electrical controls knowledge of electric and electronic to pneumatic interface such as EP switches, PE switches and transducers ability to interpret electrical diagrams, schematics, charts, fault trees and manufacturers' recommended service manuals ability to simulate changing temperatures and pressures and monitor control action ability to check operation of controls and components in a sequential manner to assure designed operation ability to check for loose, worn or frayed electrical connections ability to check electric motors and test electrical components ability to check and calibrate electric, electronic and pneumatic controls ability to set up, operate and calibrate test instruments ability to interpret test results	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

Sub-tasks	Enabling Objectives	Tools & Equipment
22.04 Checks operating temperatures, pressures and humidity.	knowledge of system design pressures, temperatures and humidity requirements	tool pouch, pressure gauge, thermometer, psychrometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of allowable tolerances for design temperature, pressure and humidity	
		knowledge of local gas utility supply pressures	
		knowledge of valve types such as thermostatic expansion valves, hot gas bypass, automatic expansion valves, capacitor, pressure regulator, crank case pressure regulating and back up pressure regulating	
		ability to locate faults such as temperature and pressure fluctuations	
		ability to identify overheating problems and impact on fluid effectiveness	
		ability to adjust valves to meet system requirements	
		ability to set up, calibrate and operate test instruments	
		ability to interpret test results	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

22.05	Assesses combustion efficiency.	knowledge of types of heating systems such as high/low fired oil systems, propane/natural gas systems, multiple stage heaters and SCR controlled heating systems	tool pouch, thermometer, smoke tester, filter paper, draft gauge, carbon dioxide analyzer, O_2 tester, electronic flue gas tester
		knowledge of principles of operation and parameters of performance of heating systems	
		ability to interpret manufacturers' specifications, diagrams and	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		instructions in regards to expected efficiency results and recommended testing procedures ability to perform combustion efficiency analysis for oil, propane, and natural gas combustion equipment ability to interpret readings such as draft, carbon dioxide, oxygen and ambient temperature readings ability to conduct smoke spot test and stack temperature measurement ability to calculate overall system efficiency from gathered tests ability to interpret test results and adjust burner and associated controls in order to improve efficiency ability to operate standard and electronic flue gas analysis kits	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

22.06	Verifies venting.	knowledge of heating system operation and designed venting requirements knowledge of types of venting systems including power venters knowledge of local code requirements and operating specifications of venting systems ability to interpret manufacturers' specifications, diagrams and instructions	tool pouch, pressure gauge, draft gauge, multimeter, voltmeter, manometer, ammeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to measure draft and interpret results	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
22.07	Checks capacity control systems.	knowledge of types of controls such as controllers, actuators, safety controls and accessories knowledge of types of heating systems and intended application knowledge of types of thermostats ability to check and calibrate electric, electronic and pneumatic flow controls and the valves actuated by them ability to set up, calibrate and operate test equipment ability to interpret electrical wiring diagrams and schematics ability to verify that valve and nozzle sizes meet system specifications	tool pouch, pressure gauge, multimeter, ammeter, thermometer, voltmeter, manometer, milliamp meter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
22.08	Checks dampers.	knowledge of types of heating systems and intended application of each knowledge of types of damper actuators and required check out procedures such as hydraulic, electric, electronic, manual and pneumatic	tool pouch, pressure gauge, multimeter, ammeter, pneumatic calibration kit

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to interpret manufacturers' specifications and instructions in regard to system set up and check out ability to interpret blueprints, electrical wiring diagrams and schematics ability to set up, operate and calibrate test instruments ability to check dampers for positioning and sealing	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

Sub-tasks	Enabling Objectives	Tools & Equipment
22.09 Checks heating capacity.	knowledge of types of heating systems, intended application and requirements of each knowledge of types of utilities such as gas, propane and oil ability to interpret manufacturers' specifications, diagrams and instructions ability to check unit burner efficiency ability to perform capacity analysis of heating systems ability to set up, calibrate and operate test equipment such as fuel meters, fluid flow meters and air flow metering devices ability to measure system temperature, voltages, currents, air, water and fuel flow	tool pouch, pressure gauge, thermometer, tachometer, psychrometer, multimeter, ammeter, manometer, CO_2 analyzer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
22.10	Verifies air flow.	knowledge of types of heating systems and intended application with regard to required air flow knowledge of types of blowers and assemblies knowledge of economizer controls and damper motors knowledge of manufacturers' specifications ability to confirm air flow is within operating parameters ability to set up, calibrate and operate air flow measuring equipment	tool pouch, thermometer, pressure gauge, velometer, multimeter, manometer, CO_2 analyzer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
22.11	Verifies combustion air flow.	knowledge of system and its intended application in regard to required combustion air flow knowledge of burner operation ability to interpret manufacturers' specifications, diagrams and schematics ability to confirm that air flow is within operating parameters ability to perform combustion analysis ability to set up, calibrate and operate air flow measuring equipment	tool pouch, thermometer, pressure gauge, velometer, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret test results	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

22.12	Tests condition of water, steam and heat distribution.	knowledge of types of heating systems, intended application and layout knowledge of required temperatures and flow rates ability to interpret charts, diagrams, tables and schematics ability to identify circulation of heats ability to acknowledge position of flow valves and associated actuators ability to interpret and record test results	tool pouch, thermometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

22.13	Checks condensate drain.	knowledge of heating system design, accessories and piping layout ability to interpret diagrams, drawings and piping layout ability to examine condensate pan and drain for fouling ability to inspect drain piping for designed pressure drops	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
22.14	Determines cause of failure.	knowledge of types of potential malfunctions in heating systems knowledge of manufacturers' specifications and operating procedures ability to interpret charts, schematics, tables, electrical wiring diagrams and diagnostic test procedures ability to test electrical components ability to identify loose connections and fittings and worn, misaligned, corroded and malfunctioning components ability to operate testing and measuring equipment ability to analyze findings and report cause of failure	tool pouch, multimeter, ammeter, pressure gauge, combustion analyzer, thermometer, psychrometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
22.15	Determines repair requirements.	knowledge of work to be performed, length of repair and time required knowledge of area of heating system to be repaired such as temperature and pressure controls, humidifiers, coils, wiring, piping and blowers knowledge of cost of system components and part availability knowledge of warranty coverage for system, parts and accessories ability to interpret manufacturers' specifications and operating instructions	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to identify and select replacement parts or components ability to isolate problem to specific area ability to determine if component replacement is feasible as compared to system replacement ability to prepare an estimate including list of parts, cost of parts and time required for repair	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
22.16	Determines warranty status.	knowledge of service and system warranty limits such as time, and degree of reimbursement knowledge of company policies regarding warranty of heating systems and service and use of used accessories/parts knowledge of general periods of warranty for parts, components and systems knowledge of extended or specific warranties that apply to heating systems or individual components of systems ability to locate and identify accessory, component and system information such as model number, serial number, manufacturer, voltage, phase, size, quantity and capacity ability to provide reason for part failure or request for warranty such as	

Sub-tasks	Enabling Objectives	Tools & Equipment
	incorrect size, defective part or broken connections	
	ability to obtain original invoices and work orders to identify installation date, supplier, manufacturer and terms of warranty	
	ability to discuss system with owner and original equipment supplier	
	ability to contact manufacturer for warranty status requirements such as part return information and warranty cards	
	ability to obtain and complete warranty card(s)	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

Task 23 **Overhauls heating systems.**

Trend: Towards existing heating systems being upgraded.

	Sub-tasks	Enabling Objectives	Tools & Equipment
23.01	Shuts down system, including lock out.	knowledge of techniques and procedures to shut down and lock out heating systems	tool pouch, padlock, multimeter
		knowledge of site specific lock out requirements	
		knowledge of types of heating systems such as high/low fired oil systems, propane/natural gas systems, multiple stage heaters and SCR controlled heating systems	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of electrical distribution panel and its purpose knowledge of types of utilities such as gas, water, steam heat, oil and propane knowledge of code requirements and operating specifications for utilities knowledge of manufacturers' specifications ability to determine required component isolation and sequence of isolation depending on expected repair(s) ability to mechanically lock out isolation devices and label in sequence ability to identify locations of primary and secondary utility isolation devices such as electrical disconnects and breakers, oil, propane, natural gas and steam supply valves ability to confirm system shutdown and lock out prior to commencing repairs ability to label lock out isolation devices in sequence	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

23.02	Disassembles heating system.	knowledge of techniques and procedures to disassemble heating systems knowledge of types of heating system components such as heat exchangers,	tool pouch, bolt cutter, rigging equipment, hoisting equipment, come-along, slings thermometer, goggles,

	Sub-tasks	Enabling Objectives	Tools & Equipment
		coils, injection system, burners, igniters and boilers and operation of each	rubber gloves, rubber boots
		ability to interpret and follow manufacturers' specifications, diagrams and instructions regarding the disassembling of heating systems	
		ability to remove piping and hardware from system	
		ability to operate rigging and hoisting equipment	
		ability to maintain sequential order when disassembling system components	
		ability to mark components for identification as to specific location(s) in order to reassemble in sequence	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

23.03	Inspects mechanical components.	knowledge of types of heating systems and components	tool pouch, vacuum cleaner, cleaning materials
		knowledge of principles of operation and parameters of performance of heating systems	
		knowledge of manufacturers' specifications	
		ability to disassemble components for inspection	
		ability to identify damage and wear to mechanical components such as vibration, fouling, foreign objects,	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		excessive heat, corrosion, uncovered parts and misalignment ability to check alignment of components and make adjustments ability to clean and lubricate components ability to assess component operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
23.04	Inspects electrical components.	knowledge of operation of heating system and components knowledge of electric, electronic and pneumatic controls ability to interpret blueprints, specifications and electrical codes and symbols ability to test ignition transformers ability to identify contact wear and pitting of relays and contactors ability to check electrical motors for bearing wear, and standby switches and insulation for damage ability to ensure electrical and energy sources are isolated ability to assess electric wiring and controls	tool pouch, multimeter, ammeter, alignment tools, pressure gauge, primary control testers, flame cell testers, thermocouple tester

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
23.05	Inspects fuel components.	knowledge of fuel filtering devices knowledge of fuel booster pump systems knowledge of fuel storage tanks, fuel tank monitoring equipment, level indicating devices and venting procedures knowledge of types of utilities such as gas, propane and oil knowledge of propane vaporizers, set up, checkout and repair procedures knowledge of designed piping layout, supports and accessories ability to set up, calibrate and operate test equipment ability to inspect fuel storage tanks for leaks ability to check fuel pumps and piping for operation, leaks, pressure output, vacuum draw and physical damage ability to adjust and service fuel regulating valves ability to interpret fuel meters	tool pouch, multimeter, ammeter, pressure gauge, voltmeter, CO_2 analyzer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
23.06	Selects electrical and mechanical replacement components.	knowledge of types and sizes of heating system components such as dampers, blowers, vents, controls, valves, piping, motors, pumps, compressors and filtering devices	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of equipment capacity, compatibility and requirements ability to interpret manufacturers' specifications, diagrams and instructions ability to refer to information on failure item(s) such as manufacturer, model number, serial number, size, capacity, voltage, phase and quantity ability to select component(s) to match type and size of system ability to determine if component replacement is feasible compared to system replacement	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

23.07	Repairs defective electrical and mechanical components.	knowledge of techniques and procedures to repair heating system components knowledge of types, sizes and capacities of components ability to interpret manufacturers' specifications and repair instructions ability to check intake tubes for damage, cracks, leaks and missing or inoperative components ability to adjust component(s) for application ability to lubricate components	tool pouch, multimeter, ammeter, pressure gauge, psychrometer, alignment tools

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to verify operation of components such as valves, heat exchangers and ignition systems	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

23.08	Replaces defective electrical and mechanical components.	knowledge of techniques and procedures to replace components such as gas valves, heat exchangers, ignition system, unit venting and controls and gas piping knowledge of types, sizes and capacities of components including valves knowledge of local utility code requirements for heating systems ability to interpret manufacturers' specifications, diagrams and instructions to assist in replacing defective components ability to select, calibrate and operate tools and test equipment ability to secure fastening devices to replaced components ability to pressure test gas piping ability to match components to meet system requirements ability to adjust and verify component for designed operation ability to lubricate components	tool pouch, multimeter, ammeter, pressure gauge, alignment tools, manometer, psychrometer, voltmeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
23.09	Reassembles heating system.	knowledge of techniques and procedures to assemble heating systems knowledge of manufacturers' designed operating conditions knowledge of rigging and hoisting techniques and procedures ability to interpret manufacturers' specifications, diagrams, procedures and adjustment operations ability to align, attach and secure components in sequential order ability to lubricate components ability to operate and interpret test instruments	tool pouch, rigging equipment, hoisting equipment, multimeter, ammeter, alignment tools

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
23.10	Arranges for certification of heating system.	knowledge of certification requirements for heating systems, components and applications knowledge of applicable local utility codes for application of heating systems knowledge of types, sizes and operation of heating systems ability to arrange for inspections and testing by authorized persons	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	NV

Task 24 **Installs heating systems.**

Trend: Towards the greater use of more energy efficient systems.

	Sub-tasks	Enabling Objectives	Tools & Equipment
24.01	Removes shipping materials.	knowledge of techniques and procedures for safe handling of heating systems knowledge of manufacturers' procedures to remove shipping materials knowledge of hoisting and rigging techniques and procedures ability to unload material and/or equipment at assigned location ability to interpret manufactures' specifications, diagrams and instructions regarding the location and removal of shipping materials ability to identify and report damages and/or shortages ability to dispose of waste materials	tool pouch, crow bar, utility knife

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	yes	no	yes	no	NV

24.02	Verifies heating system specifications.	knowledge of types of heating systems such as high/low fired oil systems, propane/natural gas systems, multiple stage heaters and SCR controlled heating systems knowledge of job site layout and load requirements knowledge of code requirements and operating specifications for utilities	

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to interpret system specifications and compare with unit nameplate	
	ability to identify and report damages and/or shortages	
	ability to confirm specifications meet design and installation practices	
	ability to confirm equipment conforms to specified materials such as size, capacity, voltage, phase, pressures, fuels, safety certification, standards and codes	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	no	yes	no	NV

24.03	Mounts heating system.	knowledge of techniques and procedures to install and mount heating systems	tool pouch, chain falls, crane, rigging equipment, genie lift, staging, ladders, electric drill
		knowledge of types, sizes and capacities of heating systems	
		knowledge of layout, location of system and space requirements	
		knowledge of equipment manufacturers' specifications	
		knowledge of hoisting and lifting procedures and devices	
		knowledge of required clearances for combustible materials as well as service clearances	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret manufacturers' specifications, diagrams and instructions ability to position and mount system in accessible location for connections and allow for vibrations and flow directions ability to employ hand signals in order to communicate with crane operator	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	no	yes	no	NV

24.04	Mounts controls and valves.	knowledge of techniques and procedures to mount controls and valves knowledge of types, sizes and capacities of controls and valves knowledge of layout, location of system and space requirements for mounting of controls and valves knowledge of wiring design, piping layout and installation codes knowledge of manufacturers' specifications, suggested layout, blueprints and shop drawings ability to identify and select controls and valves according to manufacturers' specifications, application diagrams, plans and shop drawings	tool pouch, electric drill, pipe cutters, power saw, pipe threaders, flaring tools, tube cutters, oxy-acetylene torch kit, turbo torch kit, propane torch kit

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to position controls and valves in accessible location ability to level and secure controls and valves	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
24.05	Aligns heating system.	knowledge of techniques and procedures to align heating systems knowledge of manufacturers' specifications ability to position system allowing space for connections ability to adjust positioning of heating system for specific venting, fuel piping, electric, water and control services ability to adjust system controls and valves	tool pouch, chain falls, crane, rigging, genie lift, staging, ladders, alignment tools

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
24.06	Levels heating system.	knowledge of techniques and procedures to level systems ability to obtain and interpret manufacturers' specification, diagrams and instructions	tool pouch, hoists, portable engine crane, hydraulic jacks, sockets, levels

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to align and adjust heating system level ability to verify levelling of heating system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	yes	no	yes	no	NV

24.07	Installs utilities.	knowledge of techniques and procedures to install utilities knowledge of types of utilities such as gas, water, steam heat, oil and propane knowledge of power, voltage and phase requirements knowledge of municipal permits, regulations and contact person knowledge of code requirements and operating specifications for utilities knowledge of filtration device(s) required for utilities knowledge of conditioning equipment, isolating devices, labelling and testing procedures for utilities, piping and connections ability to interpret blueprints, specifications and electrical codes and symbols ability to attach utilities to hardware and piping	tool pouch, tube benders, pipe threaders, flaring tools, swaging tools, level, torch kit

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to verify connections according to company standards and regulations	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
24.08	Installs venting system.	knowledge of techniques and procedures to install venting systems knowledge of layout and clearances knowledge of levelling techniques and procedures knowledge of crimping and flaring techniques and procedures ability to interpret manufacturers' specifications, diagrams and charts ability to cut, crimp and flare tubing materials to specified sizes and lengths ability to fasten venting to heating system	tool pouch, level, tin snips, electric drill, crimper, flaring tools, measuring tape

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
24.09	Performs leak test on system(s).	knowledge of techniques and procedures to conduct leak test on heating systems knowledge of types of refrigerants	tool pouch, pressure gauge, thermometer, air compressor and regulator, smoke bombs

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of allowable pressure testing valves	
		knowledge of manufacturers' specifications and guidelines	
		ability to select and operate leak detecting equipment	
		ability to perform tests such as hydrostatic test, smoke test and pressure tests and interpret results	
		ability to determine source of leaks	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
24.10	Arranges for certification.	knowledge of certification requirements for heating systems, components and applications	
		knowledge of applicable local utility codes for application of heating systems	
		knowledge of types, sizes and operation of heating systems	
		ability to arrange for inspections and testing by authorized personnel	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	no	yes	yes	no	no	yes	no	NV

Task 25 **Diagnoses humidifier malfunctions.**

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
25.01	Inspects humidifier assemblies visually.	knowledge of types of humidifier assemblies such as spray-type air washers, evaporative pan, electrically operated, air operated and rotating drum humidifier units knowledge of components of humidifier assemblies such as water or steam holding tank, valves, couplings, piping, tubing, fans, drive motor, pump assembly, temperature and humidity controls knowledge of principles of operation and parameters of performance of humidifier assemblies knowledge of manufacturers' specifications ability to check for water leaks, condition of electrical wires and connectors, blocked nozzles and distributor ability to check valve operation	tool pouch, thermometer, goggles, rubber gloves, rubber boots

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

25.02	Runs on-board diagnostics.	knowledge of diagnostic techniques, procedures and testing devices knowledge of humidifier assemblies and their functions knowledge of manufacturers' specifications and malfunction codes	computer terminal, printer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of troubleshooting methods	
		knowledge of operation of on-board diagnostic control devices such as touch pad and control panel	
		ability to interpret original equipment and manufacturers' specifications	
		ability to interpret information such as software and input status, wiring continuity and system failure	
		ability to detect malfunctions in humidifier assemblies	
		ability to interpret manufacturers' diagrams, specifications and instructions to aid in troubleshooting diagnoses	
		ability to identify and interpret fault codes	
		ability to interpret electrical wiring diagrams and schematics	
		ability to check system and components to confirm fault code origination	
		ability to operate troubleshooting equipment such as computer, key pad and printer	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

25.03	Checks voltage, current and amperage draw.	knowledge of operating procedures for electric/electronic components	tool pouch, voltmeter, multimeter, ammeter
		knowledge of components of humidifier assemblies such as water	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		or steam holding tank, valves, couplings, piping, tubing, fans, drive motor, pump assembly, temperature and humidity controls	
		knowledge of principles of operation and parameters of performance of humidifier assemblies	
		ability to interpret electrical diagrams, schematics, charts, fault trees and manufacturers' recommended service manuals	
		ability to simulate changing temperatures and pressures and monitor control action	
		ability to check operation of controls and components in a sequential manner to assure designed operation	
		ability to check for loose, worn or frayed electrical connections	
		ability to check electric motors and test electrical components	
		ability to check and calibrate electric, electronic and pneumatic controls	
		ability to select and operate tools and test instruments	
		ability to interpret test results	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

25.04	Checks operating temperatures and humidity for dehumidifiers.	knowledge of system design temperatures and humidity requirements	tool pouch, multimeter, ammeter, thermometer, psychrometer, hygrometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of allowable tolerances for design temperature and humidity	
		knowledge of types and sizes of valves	
		ability to interpret psychrometric charts for air volume, humidity ratio and saturation	
		ability to locate faults such as temperature fluctuations	
		ability to identify overheating problems and impact on fluid effectiveness	
		ability to adjust valves to meet design requirements	
		ability to set up, calibrate and operate test instruments	
		ability to interpret test results	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

25.05	Checks capacity control system(s).	knowledge of humidifier assemblies and intended application	tool pouch, thermometer, voltmeter, multimeter, ammeter, pressure gauge
		knowledge of types of capacity controls used in humidifier assemblies	
		ability to interpret manufacturers' specifications, electrical wiring diagrams and schematics	
		ability to check and calibrate electric, electronic and pneumatic flow	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		controls and the valves actuated by them	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
25.06	Verifies air flow across humidifier.	knowledge of types of humidifier systems and intended application with regard to required air flow knowledge of types of components of humidifier assemblies such as water or steam holding tanks, drive motors and pump assemblies knowledge of manufacturers' specifications ability to confirm air flow is within operating parameters ability to set up, calibrate and operate air flow measuring equipment	tool pouch, thermometer, pressure gauge, velometer, multimeter, manometer, CO_2 analyzer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
25.07	Calibrates nozzles.	knowledge of calibration techniques and procedures knowledge of types, sizes and purpose of nozzles knowledge of required spray patterns ability to disassemble and assemble components in order to calibrate nozzles	pressure gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
25.08	Determines cause of failure.	knowledge of types of humidifier assemblies such as spray-type air washers, evaporative pan, electrically operated, air operated and rotating drum humidifier units knowledge of types of humidifier assembly components such as water or steam holding tank, valves, couplings, piping, tubing, fans, drive motor, pump assembly, temperature and humidity controls knowledge of on-board diagnostics codes knowledge of manufacturers' specifications, principles of operation and parameters of performance of humidifier assemblies knowledge of types of potential malfunctions in humidifiers ability to interpret charts, schematics, electrical wiring diagrams and diagnostic test procedures ability to operate testing and measuring equipment ability to test electrical components and observe loose connections and fittings ability to identify worn, misaligned, corroded and malfunctioning components ability to check operation of controls ability to isolate problem to specific area/component	tool pouch, multimeter, ammeter, pressure gauge, thermometer, psychrometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to analyze findings and report cause of failure	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

25.09	Determines repair requirements.	knowledge of types of humidifier assemblies such as spray-type air washers, evaporative pan, electrically operated, air operated and rotating drum humidifier units knowledge of work to be performed, length of repair and time required knowledge of area or types of components to be repaired such as humidity, temperature and pressure controls, electrical, water or steam valves, drive motors and/or pump assemblies knowledge of cost of system components and part availability knowledge of warranty coverage ability to interpret manufacturers' specifications, diagrams, instructions and diagnostic test procedures ability to isolate problem to specific area or component ability to determine if component replacement is feasible as compared to system replacement ability to identify and select replacement parts or components ability to prepare an estimate including list of parts, cost of parts	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		and repair, and time required for repair	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

25.10	Determines warranty status.	knowledge of service and system warranty limits such as time, and degree of reimbursement knowledge of company policies regarding warranty of humidifiers and service and use of used accessories/parts knowledge of general periods of warranty for parts, components and systems knowledge of extended or specific warranties that apply to humidifiers or individual components of system ability to locate and identify accessory, component and system information such as model number, serial number, manufacturer, voltage, phase, size, quantity and capacity ability to provide reason for part failure or request for warranty such as incorrect size, defective part or broken connections ability to obtain original invoices and work orders to identify installation date, supplier, manufacturer and terms of warranty ability to discuss humidifier assembly with owner and original equipment supplier	

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to contact manufacturer for warranty status requirements such as part return information and warranty cards	
	ability to obtain and complete warranty card(s)	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

Task 26 **Overhauls humidifiers.**

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
26.01	Isolates feed water or steam water.	knowledge of techniques and procedures to isolate feed water or steam water	tool pouch, padlock, manometer, multimeter
		knowledge of types and sizes of valves and their function	
		knowledge of types of isolation valves and valve positions such as open/closed	
		knowledge of system components and piping arrangement	
		knowledge of reactions of water flow to isolation	
		ability to refer to manufacturers' recommended procedures, tables and piping drawings	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to activate valves to isolate feed water or steam water lines and/or components ability to set up, calibrate and operate test instruments	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

26.02	Disassembles humidifiers.	knowledge of techniques and procedures to disassemble humidifiers knowledge of types of humidifier assemblies such as spray-type air washers, evaporative pan, electrically operated, air operated and rotating drum humidifier units knowledge of types of humidifier assembly components such as water or steam holding tank, valves, couplings, piping, tubing, fans, drive motor, pump assembly, temperature and humidity controls ability to remove piping and hardware from system ability to interpret manufacturers' specifications, charts, diagrams and instructions ability to maintain sequential order when disassembling system components ability to repair/replace drain ability to flush and clean units	tool pouch, bolt cutter, rigging equipment, hoisting equipment

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to mark components in order to reassemble in sequence	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

26.03	Inspects for scale condition.	knowledge of principles of operation of humidifiers and parameters of performance knowledge of water treatment and chemical additives ability to examine reservoir pan, float assembly and nozzles ability to check system and components for corrosion, fouling, frost build-up and damage	pH tester

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

26.04	Inspects condition of electrical components and controls.	knowledge of types of electrical components and electric, electronic and pneumatic controls ability to interpret blueprints, specifications and electrical codes and symbols ability to identify contact wear and pitting of relays and contactors ability to check electrical motors for bearing wear, standby switches and insulation ability to ensure electrical and energy sources are isolated	tool pouch, multimeter, ammeter, psychrometer, primary control tester, flame cell tester, thermocouple tester

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to test solenoid valves, float assemblies and anti-flush devices	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

26.05	Selects replacement components.	knowledge of types and sizes of humidifier assemblies and components such as humidity controls, water and steam valves, pump assemblies, infrared lamps, auto-flush devices, drive motors and controls knowledge of equipment capacity, compatibility and requirements ability to interpret manufacturers' specifications, diagrams and instructions ability to select types and sizes of components to match assemblies ability to interpret information on failure item(s) such as manufacturer, model number, serial number, size, capacity, voltage, phase and quantity ability to determine if component replacement is feasible compared to system replacement	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

26.06	Cleans float assemblies.	knowledge of techniques and procedures for cleaning float assemblies knowledge of cleaning equipment and materials	wipers, pail, rubber gloves, goggles, respirator

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of reaction of cleaning agents/solvents on system components	
		ability to assess need for cleaning such as visual, system performance, company or manufacturers' specifications and/or contracted agreement	
		ability to interpret manufacturers' suggested recommendations for cleaning float assemblies	
		ability to disassemble and assemble components for cleaning	
		ability to verify operation of float assembly	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
26.07	Calibrates nozzles.	knowledge of calibration techniques and procedures	tool pouch, pressure gauge
		knowledge of types, sizes and purpose of nozzles	
		knowledge of required spray patterns	
		ability to disassemble and assemble components in order to calibrate nozzles	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
26.08	Conditions water.	knowledge of types of water treatment and chemical additives	pH analyzer, hose

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of techniques and procedures to condition water ability to interpret manufacturers' instructions ability to select chemicals in order to prevent corrosion, algae or scale build-up	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

26.09	Replaces humidifier components.	knowledge of techniques and procedures to replace components knowledge of types of humidifiers and application of each knowledge of types, sizes and capacities of components such as water or steam holding tank, valves and couplings, piping and tubing, fan, pump assembly, drive motors and controls, temperature and humidity controls knowledge of original equipment manufacturers' (OEM) parts replacement procedures ability to interpret manufacturers' specifications, charts, diagrams and instructions ability to select components to match humidifier assembly requirements ability to select and operate tools ability to verify operation of replacement component/system	tool pouch, pressure gauge, alignment tools, multimeter, ammeter, psychrometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to adjust component for designed operation ability to lubricate components	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
26.10	Reassembles humidifier system.	knowledge of techniques and procedures to assemble humidifier systems knowledge of operation of humidifiers and components knowledge of electrical and installation codes knowledge of manufacturers' required operating conditions ability to interpret manufacturers' specifications, charts, diagrams, procedures and adjustment operations ability to select and operate tools ability to reassemble components in sequential order ability to operate tools and measuring instruments ability to align, attach and secure components	tool pouch, electric drill, electric hammer, power saw, multimeter, psychrometer, alignment tools

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
26.11	Performs leak test on system.	knowledge of leak test methods and safety precautions	tool pouch, hose, goggles, gloves

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of allowable pressure testing valves	
	knowledge of manufacturers' specifications and guidelines	
	ability to select and operate leak detecting equipment	
	ability to perform testing procedures such as hydrostatic test, smoke test and pressure tests	
	ability to determine source of leaks	
	ability to interpret test results	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

Task 27 Installs humidifiers.

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
27.01	Removes shipping materials.	knowledge of techniques and procedures for handling humidifiers	tool pouch, crow bar, power saw
		knowledge of manufacturers' procedures to remove shipping materials	
		knowledge of hoisting and rigging techniques and procedures	
		ability to unload material and/or equipment at assigned location	

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to interpret manufacturers' specifications, diagrams and instructions regarding the location and removal of shipping materials ability to identify and report damages and/or shortages ability to dispose of waste materials	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	yes	yes	yes	no	NV

Sub-tasks	Enabling Objectives	Tools & Equipment
27.02 Verifies humidifier specifications.	knowledge of types of humidifier assemblies and components knowledge of electrical ratings, amperages, voltages knowledge of job site, layout and load requirements ability to interpret system specifications and compare with unit nameplate ability to identify and report damages and/or shortages ability to confirm that specifications meet design and installation practices ability to confirm equipment and materials have been ordered ability to confirm equipment on site conforms to specified materials such as size, capacity, voltage, phase, pressures, fuels, safety certification, standards and codes	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
27.03	Mounts humidifier.	knowledge of types, sizes and capacities of humidifiers such as spray-type air washers, evaporative pan, electrically operated, air operated and rotating drum humidifier units knowledge of techniques and procedures to mount humidifiers knowledge of site layout, space requirements and accessibility knowledge of the fundamentals of air flow, adequate water supply, drainage facilities, duct and piping layout knowledge of installation codes and regulations knowledge of rigging and hoisting techniques and procedures ability to interpret manufacturers' specifications, diagrams, tables and charts ability to select and operate tools and equipment	tool pouch, electric hammer, electric drill, rigging equipment, hoisting equipment

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	yes	yes	no	NV

27.04	Levels humidifier.	knowledge of techniques and procedures to level humidifiers knowledge of types, sizes and capacities of humidifiers knowledge of rigging and hoisting techniques and procedures	tool pouch, level, alignment tools

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to align unit so that the water is level in the humidifier reservoir	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	yes	yes	yes	no	NV

27.05	Connects electric motor or power supply.	knowledge of techniques and procedures to connect electric motor to power supply knowledge of types and sizes of piping, hardware and fittings knowledge of piping layout knowledge of space requirements, mounting methods and humidifier selection knowledge of power, voltage and phase requirements knowledge of electrical and installation codes ability to interpret blueprints, specifications and electrical codes and symbols ability to verify connections according to code specifications **(NOT COMMON CORE)**	tool pouch, ohmmeter, voltmeter, ammeter, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	no	yes	no	NV

27.06	Connects piping/tubing and drains.	knowledge of techniques and procedures to connect piping/tubing and drains	tool pouch, tube cutters, reamer, bending tools, pipe threaders, torch kit

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types and sizes of piping/tubing including attachments and fasteners knowledge of space requirements, mounting methods, humidifier selection, specified air flow, adequate water supply, drain facilities, accessibility, duct layout, piping layout and installation codes knowledge of brazing and welding techniques and procedures ability to interpret blueprints and specifications ability to estimate type, size and amount of piping/tubing ability to cut pipe/tube and make pipe/tube and drain connections	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	yes	yes	no	NV

27.07	Checks piping/tubing connections including couplings and fittings.	knowledge of types and sizes of connections, couplings and fittings knowledge of techniques and procedures for piping/tubing connections knowledge of piping diagrams including codes and symbols ability to interpret blueprints, charts, schematics and specifications ability to assess connection state and check for defects/damage ability to adjust connections	tool pouch

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to make all joints leak proof	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	yes	yes	no	NV

27.08	Performs leak test on system.	knowledge of techniques and procedures to perform a leak test	tool pouch, hose, pressure gauge
		knowledge of safety precautions	
		knowledge of manufacturers' specifications and guidelines	
		ability to interpret test results	
		ability to determine source of leaks	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	yes	yes	no	NV

Task 28 **Diagnoses ventilation and air exchange system malfunctions.**

Trend: Towards increased air quality and energy efficiency.

	Sub-tasks	Enabling Objectives	Tools & Equipment
28.01	Inspects ventilation and air exchange systems.	knowledge of types of ventilation and air exchange systems	tool pouch
		knowledge of operation of ventilation and air exchange systems	
		ability to interpret prints, graphs, charts, schematics and tables	

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to identify assemblies and components for malfunctions ability to identify physical damage and defects ability to document findings	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

Sub-tasks	Enabling Objectives	Tools & Equipment
28.02 Runs on-board diagnostics.	knowledge of diagnostic techniques, procedures and testing devices knowledge of types of ventilation and air exchange systems and their functions knowledge of trouble-shooting methods knowledge of operation of on-board diagnostic control devices such as touch pad and control panel ability to interpret original equipment and manufacturers' literature ability to interpret information such as software and input status, wiring continuity and system failure ability to identify and interpret fault codes ability to interpret electrical wiring diagrams and schematics ability to check system and components to confirm fault code origination	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to operate specialized troubleshooting equipment such as computers, key pad and printers computer, printer	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
28.03	Checks functionality and output of electrical components.	knowledge of operating procedures for electric/electronic components knowledge of ventilation and air exchange system components ability to interpret electrical diagrams, charts, fault trees and manufacturers' specifications and instructions ability to interpret electrical wiring diagrams and schematics ability to simulate changing temperatures and pressures and monitor control action ability to check for loose, worn or frayed electrical connections ability to check electric motors and test electrical components ability to interpret test results ability to adjust and check operation of controls and components in a sequential manner to assure required operation ability to check and calibrate electric, electronic and pneumatic controls	tool pouch, voltmeter, ammeter, multimeter, pressure gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
28.04	Checks operating temperatures, pressures and humidity.	knowledge of system design including temperatures, pressures, and humidity requirements knowledge of allowable tolerances for design temperature, pressure and humidity knowledge of equipment manufacturers' operation and maintenance specifications ability to measure temperatures and pressures and compare with design of system ability to locate faults such as temperature and pressure fluctuations ability to identify overheating problems and impact on effectiveness ability to adjust valves to meet requirements ability to set up, calibrate and operate test instruments ability to interpret test results	tool pouch, thermometer, pressure gauge, psychrometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

28.05	Checks capacity control system.	knowledge of system and intended application knowledge of types of air volume controls used in ventilation and air exchange systems such as speed controlled motors, damper modulators and variable inlet vanes ability to interpret manufacturers' specifications, diagrams and	tool pouch, thermometer, voltmeter, multimeter, ammeter, pressure gauge

	Sub-tasks	Enabling Objectives	Tools & Equipment
		instructions in regards to checking and setting up capacity control systems ability to interpret electrical wiring diagrams and schematics ability to check and calibrate electric, electronic and pneumatic flow controls and the valves actuated by them ability to interpret test results	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
28.06	Checks dampers.	knowledge of system and its intended application knowledge of types of damper actuators and required check out procedures such as hydraulic, electric, electronic, manual and pneumatic ability to interpret manufacturers' specifications, diagrams and instructions in regards to system set up and checkout ability to interpret blueprints, electrical wiring diagrams and schematics ability to check damper for positioning and sealing	tool pouch, multimeter, ammeter, pressure gauge, pneumatic calibration kit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
28.07	Checks heating capacity.	knowledge of types of ventilation and air exchange systems, intended application and requirements ability to interpret manufacturers' specifications, diagrams and instructions ability to perform capacity analysis of ventilation and air exchange systems ability to operate fuel meters, fluid flow meters, and air flow measuring devices ability to measure system temperature, voltage, current, air flow, meter-flow of water, fuel and steam ability to interpret test readings	tool pouch, pressure gauge, flow meter, volumeter, thermometer, tachometer, psychrometer, multimeter, ammeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
28.08	Verifies air flow.	knowledge of ventilation and air exchange systems and intended application ability to refer to manufacturers' specifications, diagrams and charts ability to check for required air flow ability to operate air flow measuring equipment ability to interpret test readings	tool pouch, pressure gauge, velometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
28.09	Tests condition of distribution of water/steam.	knowledge of system, its intended application and layout knowledge of required temperatures and flow rates ability to recognize circulation of heat ability to recognize position of flow valves and associated actuators ability to identify source of malfunction or problem	tool pouch, thermometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	yes	yes	no	NV

28.10	Determines cause of failure.	knowledge of types of ventilation and air exchange system components such as dampers, pressure regulators, valves, air volume controls and speed control motors knowledge of manufacturers' specifications and operating procedures knowledge of types of potential malfunctions in ventilation and air exchange systems ability to interpret electrical wiring diagrams and diagnostic test procedures ability to operate testing and measuring equipment ability to identify worn, misaligned, corroded and malfunctioning components ability to test electrical components and analyze findings	tool pouch, multimeter, ammeter, pressure gauge, combustion analyzer, thermometer, psychrometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to report cause of failure ability to observe loose connections and fittings and isolate problem to specific area/component	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

28.11	Determines repair requirements.	knowledge of work to be performed, length of repair and time required knowledge of manufacturers' specifications knowledge of area of system to be repaired such as electrical, temperature and/or pressure controls knowledge of single zone, multi-zone, air induction, water induction, variable air vent (VAV) systems, terminal reheat dual duct system and variable volume by temperature (VVT) systems knowledge of cost of system components and part availability knowledge of warranty coverage ability to determine if system/component(s) should be repaired or replaced ability to interpret diagnostic test procedures ability to isolate problem to specific area	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to prepare an estimate including list of parts, cost of repair and time required for repair	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

28.12	Determines warranty status.	knowledge of service and system warranty limits such as time, and degree of reimbursement	
		knowledge of company policies regarding warranty of ventilation and air exchange systems and service and use of used accessories/parts	
		knowledge of general periods of warranty for parts, components and systems	
		knowledge of extended or specific warranties that apply to ventilation and air exchange systems or individual components and/or assemblies of system	
		ability to locate and identify accessory, component and system information such as model number, serial number, manufacturer, voltage, phase, size, quantity and capacity	
		ability to provide reason for part failure or request for warranty such as incorrect size, defective part or broken connections	
		ability to obtain original invoices and work orders to identify installation date, supplier, manufacturer and terms of warranty	
		ability to discuss system with owner and original equipment supplier	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to contact manufacturer for warranty status requirements such as part return information and warranty cards	
		ability to obtain and complete warranty card(s)	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

Task 29 **Overhauls ventilation and air exchange systems.**

Trend: Towards increased air quality and energy efficiency.

	Sub-tasks	Enabling Objectives	Tools & Equipment
29.01	Shuts down system, including lock out.	knowledge of techniques and procedures to shut down and lock out ventilation and air exchange systems	tool pouch, padlock, multimeter, ammeter, pressure gauge
		knowledge of types of ventilation and air exchange systems	
		knowledge of manufacturers' specifications	
		knowledge of system and its layout in regard to identifying locations of primary and secondary utility isolation devices such as electrical disconnects, electrical breakers, oil, propane, water and steam supply valves	
		knowledge of secondary components in service with isolation device that requires prior shutdown such as alarms, pumps and vaporizers	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to determine necessary component isolation and sequence of isolation depending on expected repair	
		ability to interpret prints, graphs, charts, schematics and tables	
		ability to identify assemblies and components and determine fundamentals of operation of each	
		ability to ensure electrical and energy sources are isolated	
		ability to mechanically lock out isolation devices and to label in order to prevent accidental tampering	
		ability to confirm sudden shutdown and lock out prior to commencing required repairs	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

29.02	Disassembles ventilation and air exchange system.	knowledge of techniques and procedures to disassemble ventilation and air exchange system	tool pouch, bolt cutter, rigging equipment, hoisting equipment, come-along, slings
		knowledge of types of ventilation and air exchange systems components such as dampers, pressure regulators, valves, air volume controls and speed control motors	
		knowledge of pipe connections and fittings	
		ability to interpret manufacturers' specifications, diagrams and instructions	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to identify defective components ability to operate rigging and hoisting equipment ability to maintain sequential order when disassembling ventilation and air exchange system components ability to mark components in order to reassemble in sequence	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

29.03	Inspects mechanical components.	knowledge of types of mechanical ventilation and air exchange components knowledge of manufacturers' specifications and testing procedures ability to identify worn, corroded, loose or malfunctioning components ability to check alignment and make minor adjustments to mechanical components including controls ability to disconnect and replace duct work ability to detect defective components ability to identify damage to components such as vibration, fouling, excessive heat, corrosion, foreign objects, misalignment ability to disassemble component(s) for inspection	tool pouch, vacuum cleaner, alignment tools

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to lubricate components ability to assess system operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
29.04	Inspects electrical components.	knowledge of types of electrical components knowledge of testing procedures for electrical components knowledge of electric, electronic and pneumatic controls ability to disconnect and replace duct work ability to check electrical motors for bearing wear, starting switch for damage and insulation for breakdown ability to identify contact wear and pitting of relays and contactors ability to test ignition transformers ability to test solenoid valves	tool pouch, multimeter, ammeter, alignment tools, pressure gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
29.05	Selects replacement components.	knowledge of types and sizes of system components such as dampers, pressure regulators, valves, air volume controls and speed control motors knowledge of electrical and installation codes	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of equipment capabilities and requirements knowledge of equipment capacity and compatibility ability to select component to match type of system ability to select and operate required tool ability to identify system/component information such as manufacturer, model, serial, size, capacity, voltage, phase and quantity ability to interpret manufacturers' specification, diagrams and instructions to assist in the identification of parts and components ability to determine if components repair is feasible as compared to component/system replacement	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

29.06	Repairs defective components.	knowledge of techniques and procedures to repair ventilation and air exchange components knowledge of types, sizes and capacities of components ability to identify assemblies and components and determine fundamentals of operation of each ability to interpret manufacturers' specifications, diagrams and instructions for component repair	tool pouch, multimeter, ammeter, pressure gauge, thermometer, psychrometer

Sub-tasks		Enabling Objectives	Tools & Equipment
		ability to disassemble, reassemble and replace parts and in sequential order ability to test component and verify operation ability to adjust component for application	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

29.07	Replaces defective components.	knowledge of techniques and procedures to replace components knowledge of types and sizes of components and their operation ability to interpret manufacturers' specifications, blueprints, diagrams and instructions ability to select replacement components ability to replace bearings in fan or blower assemblies ability to test and adjust component(s) for designed operation ability to verify operation of component/system	tool pouch, multimeter, ammeter, pressure gauge, alignment tools, thermometer, psychrometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

29.08	Reassembles ventilation and air exchange system.	knowledge of techniques and procedures to assemble ventilation and air exchange systems	tool pouch, electric drill, electric saw, rigging equipment, hoisting equipment, alignment

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of operation of ventilation and air exchange systems	tools, multimeter, ammeter
		knowledge of types and sizes of components and their function	
		ability to interpret manufacturers' specifications, diagrams and instructions to assist in reassembling ventilation and air exchange systems	
		ability to select and operate tools	
		ability to reassemble components in sequential order	
		ability to align, attach and secure components	
		ability to test operation of components and system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 30 Installs ventilation and air exchange systems.

Trend: Towards increased air quality and system efficiency.

	Sub-tasks	Enabling Objectives	Tools & Equipment
30.01	Removes shipping materials.	knowledge of techniques and procedures for handling ventilation and air exchange systems	tool pouch, crow bar, utility knife
		knowledge of manufacturers' procedures to remove shipping materials	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of hoisting and rigging techniques and procedures ability to unload material and/or equipment at assigned location ability to ensure that parts received match invoice ability to interpret manufacturers' specifications, diagrams and instructions regarding the location and removal of shipping materials ability to identify and report damages and/or shortages ability to dispose of waste materials	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	yes	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
30.02	Verifies ventilation and air exchange system specifications.	knowledge of ventilation and air exchange system including components knowledge of job site load, space requirements, mounting methods and layout procedures ability to interpret prints, graphs, tables, diagrams and schematics ability to confirm that equipment and materials have been ordered ability to confirm equipment on site conforms to specified materials such as size, capacity, voltage, phase, pressure, fuels, safety conditions and standard and code	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to identify and report damages and/or shortages	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	yes	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
30.03	Mounts ventilation and air exchange system.	knowledge of techniques and procedures to mount ventilation and air exchange systems knowledge of safe rigging and hoisting procedures knowledge of layout, location of system and space and clearance requirements ability to communicate approved hand signals for hoisting and rigging ability to interpret manufacturers' specifications, diagrams and instructions ability to position system for access locations	tool pouch, chain falls, crane, rigging equipment, genie lift, ladders, electric drill, levels

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	yes	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
30.04	Mounts controls or valves.	knowledge of types, sizes and capacities of controls and valves knowledge of techniques and procedures to mount controls and valves knowledge of layout, location of system and space and clearance requirements	tool pouch, electric drill, pipe threaders, flaring tools, tube cutters, torch kit

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of required positioning and mounting of controls and valves for operation and service	
	knowledge of safe rigging and hoisting procedures	
	ability to interpret blueprints and shop drawings	
	ability to identify and select controls according to manufacturers' specifications, application diagrams, plans and shop drawings	
	ability to position controls and/or valves in accessible location	
	ability to communicate approved hand signals for hoisting and rigging	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	no	yes	no	NV

Sub-tasks	Enabling Objectives	Tools & Equipment
30.05 Aligns device.	knowledge of techniques and procedures to align air handling systems	tool pouch, rigging equipment, alignment tools
	ability to interpret manufacturers' specifications, diagrams and instructions to aid in alignment of device	
	ability to adjust device allowing space for connections such as positioning of vents, fuel piping, electrical, water and control services	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to anchor device **(NOT COMMON CORE)**	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	no	yes	no	NV

30.06	Levels device.	knowledge of levelling techniques and procedures ability to select and operate levelling devices ability to interpret manufacturers' specifications, diagrams and instructions in regards to levelling and anchoring of device ability to align, position and adjust device	tool pouch, hoisting equipment, hydraulic jacks, sockets, bubble level, line level, precision level

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	yes	no	yes	no	NV

30.07	Connects electric motor or power supply.	knowledge of techniques and procedures to connect electric motor and power supply knowledge of electrical and installation codes including polarity knowledge of power, voltage and phase requirements knowledge of permits and regulations ability to interpret blueprints, building layout, electrical codes and symbols ability to attach utilities to hardware and piping	tool pouch, ammeter, voltmeter, ohmmeter, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to verify connections according to company standards and manufacturers' specifications	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	yes	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
30.08	Connects gas piping/tubing and fittings.	knowledge of techniques and procedures for connecting piping/tubing and fittings knowledge of layout, location of system, space and clearance requirements knowledge of types and sizes of piping/tubing and fittings ability to interpret blueprints, schematics, graphs and charts ability to braze, solder, weld ability to attach fittings ability to select and operate tools and test instruments **(NOT COMMON CORE)**	tool pouch, pressure gauge, torch kit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	no	no	no	yes	yes	no	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
30.09	Checks gas piping/tubing connections.	knowledge of piping/tubing connection techniques and procedures knowledge of piping diagrams including codes and symbols	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret blueprints, diagrams, schematics and specifications ability to assess connections and check for defects/damage ability to adjust connections including couplings and fittings ability to identify replacement needs ability to identify faulty pipe/tubing connections **(NOT COMMON CORE)**	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	no	no	no	yes	yes	no	no	yes	no	NV

30.10	Performs leak test on system.	knowledge of leak test methods and safety precautions knowledge of manufacturers' specifications and guidelines ability to select and operate leak detecting equipment ability to interpret test results ability to determine source of leaks **(NOT COMMON CORE)**	tool pouch, manifold pressure gauge, thermometer, leak detector

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	no	yes	yes	no	no	yes	no	NV

30.11	Arranges for certification.	knowledge of certification requirements for ventilation and air exchange systems	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types, sizes and operation of ventilation and air exchange systems	
		knowledge of local gas codes	
		ability to arrange for inspections and testing by authorized personnel	
		(NOT COMMON CORE)	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	no	no	no	yes	yes	no	no	yes	no	NV

Task 31 **Diagnoses air cleaning assembly malfunctions.**

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
31.01	Inspects air cleaning assemblies visually and audibly.	knowledge of types of air cleaning assemblies and components such as filter, recirculating pump, power pack, wiring and controls, washer nozzle and holding tank	tool pouch, stethoscope, alignment tools
		knowledge of existing system and its intended application	
		knowledge of manufacturers' specifications	
		ability to visually check condition of filtration device for fouling, corrosion and physical damage	
		ability to audibly check air cleaning devices for filtration blockage and designed operation of electronic air cleaners	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to check alignment of components	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

31.02	Checks functionality and output of electric/ electronic components.	knowledge of operation of electric/electronic components knowledge of types of air cleaning assemblies such as electronic, air washer, filter, dry and viscous ability to interpret electrical wiring diagrams, schematics, charts and manufacturers' recommended service manuals ability to identify components and determine operation of each ability to verify operation of controls and components in a sequential manner to assure operation ability to check for loose, worn or frayed electrical connections ability to check electric motors and test electrical components ability to check and calibrate electric/electronic controls ability to interpret test results ability to assess need for cleaning such as visual, system performance, company or manufacturers' specifications, standards, contracted agreement	tool pouch, ammeter, multimeter, voltmeter, pressure gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
31.03	Checks operating pressures across cleaner.	knowledge of system design pressure measurements for existing air cleaning assemblies knowledge of allowable tolerances for design pressures ability to identify overheating problems ability to adjust valves to meet requirements ability to set up, calibrate and operate test instruments ability to interpret test results	tool pouch, pressure gauge, incline manometer, U-tube manometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
31.04	Verifies air flow.	knowledge of system and designed air flow requirements ability to set up, calibrate and operate air measuring equipment ability to confirm air flow	tool pouch, vane anemometer, incline manometer, hot wire anemometer, pitot tube, tachometer, deflecting vane aneometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
31.05	Conducts air quality test.	knowledge of conditions in which air quality is to be analyzed such as building materials, sources of ventilation, types of activities, operating and maintenance programs and procedures knowledge of occupant concerns such as medical/health problems	tool pouch, gas analyzer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of feasible sources of contamination such as carbon monoxide, carbon dioxide, respirable particles, organic vapours, nitrogen dioxide, sulphur dioxide, total suspended particles without smoking, sulphate, formaldehyde, radon and progeny, asbestos, mineral and synthetic fibres, viable organisms and ozone knowledge of allowable indoor concentrators and contaminants ability to visually inspect site for possible sources of contamination and obtain samples ability to interpret test results and identify sources of contamination and corrective solutions ability to obtain air samples ability to send air samples out to be analyzed	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	no	yes	yes	no	no	yes	no	NV

31.06	Checks drive assembly on automatic air cleaners.	knowledge of techniques and procedures to check drive assembly knowledge of types of air cleaners and designed capabilities knowledge of the existing air cleaner drive assembly ability to interpret manufacturers' specifications, diagrams and instructions	tool pouch, alignment tools

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to check drive assembly for wear, damage and misalignment	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

31.07	Determines repair requirements.	knowledge of work to be performed, length of repair and time required knowledge of area of air cleaning assembly to be repaired such as wiring, temperature and pressure controls, filters, piping, holding tank and pump knowledge of cost of assembly components and part availability knowledge of warranty coverage ability to refer to manufacturers' specifications and instructions for model number, serial number, size and capacity ability to identify, select and obtain replacement part or component ability to determine if component repair is feasible as compared to component/system replacement	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

31.08	Determines warranty status.	knowledge of service and system warranty limits such as time, and degree of reimbursement	

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of company policies regarding warranty of air cleaning assemblies and service and utilization of used accessories/parts	
	knowledge of general periods of warranty for parts, components and systems	
	knowledge of extended or specific warranties that apply to air cleaning assemblies	
	ability to identify parts, components and system information such as manufacturer, model number, serial number, size, quantity, capacity, voltage and phase	
	ability to obtain invoices and purchase orders to identify installation date, manufacturer and supplier names	
	ability to contact manufacturer or supplier for warranty status requirements such as part return information and warranty cards	
	ability to obtain and complete warranty card(s)	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

Task 32 **Overhauls air cleaning assemblies.**

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
32.01	Shuts down system, including lock out.	knowledge of types of air cleaning assemblies and components such as filters, recirculating pump, power pack, wiring and controls, washer nozzle and holding tank knowledge of techniques and procedures to shut down air cleaning assemblies knowledge of manufacturers' specifications ability to identify location of primary and secondary utility isolation devices ability to determine required component isolation and sequence of isolation ability to mechanically lock out and label isolation device(s) ability to confirm system shutdown and lock out prior to commencing of repairs	tool pouch, padlock, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
32.02	Isolates air cleaning assembly.	knowledge of techniques and procedures to isolate air cleaning assemblies knowledge of assembly components such as filter, recirculating pump, power pack, wiring, controls, washer nozzle and holding tank knowledge of shut down and start up procedures	tool pouch, padlock, pressure gauge, ammeter, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret manufacturers' specifications, prints, schematics and charts ability to identify components of air cleaning assembly ability to isolate and label air cleaning assembly ability to recognize normal and abnormal operation of control	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

32.03	Disassembles air cleaning assembly.	knowledge of techniques and procedures to disassemble air cleaning assemblies knowledge of types of air cleaning assemblies such as electronic, air washer, filter, dry and viscous type air cleaner assemblies knowledge of air cleaning assembly components such as filter, recirculating pump, power pack, wiring, controls, washer nozzle and holding tank knowledge of pipe connections and fittings ability to clean the holding tank and lines ability to repair electrical components ability to interpret manufacturers' specifications, diagrams and instructions	tool pouch, bolt cutter, electric drill, electric hammer, power saw, ohmmeter, voltmeter, ammeter, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to verify disassembly and mark components for assembling sequentially	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
32.04	Inspects components.	knowledge of types of air cleaner assembly components and location of each ability to inspect components and parts for physical damage, wear, alignment and corrosion, excessive heat, fouling and incorrect parts ability to identify worn, frayed, loose or broken wiring ability to recognize defective components ability to identify corrosion, algae or scale build up	tool pouch, micrometer, alignment tools

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
32.05	Selects replacement components.	knowledge of air cleaner assembly components and their function ability to identify replacement parts and components ability to obtain complete information on failure items such as manufacturers' name, model number, serial number, size, capacity, quantity, voltage and phase ability to interpret manufacturers' specifications, diagrams and	tool pouch, multimeter, ammeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		instructions to assist in the identification of parts and components ability to determine if component repair is feasible as compared to component and system replacement	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
32.06	Repairs defective components.	knowledge of techniques and procedures to repair air cleaner assembly components knowledge of types and sizes of components such as recirculating pump, filters, power pack, wiring and controls, washer nozzle and holding tank knowledge of ionizing and charged media type electronic filters ability to interpret manufacturers' specifications, diagrams and instructions ability to repair electrical components ability to adjust and lubricate components ability to test and verify operation of component/system	tool pouch, multimeter, ammeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
32.07	Cleans components.	knowledge of types of components such as filter, recirculating pump,	vacuum cleaner, brush, pressure sprayer, hand

	Sub-tasks	Enabling Objectives	Tools & Equipment
		power pack, wiring and controls, washer nozzle and holding tank	sprayer, goggles, gloves, respirator
		knowledge of dismantling procedures for components	
		knowledge of cleaning techniques and procedures for components	
		knowledge of cleaning equipment and materials such as vacuum cleaner, chemical solvents, forced air, brushes and cleaning cloths	
		knowledge of maintenance schedules for air cleaners and components	
		ability to assess need for cleaning such as visual, system performance, company or manufacturers' specifications, standards, contracted agreement	
		ability to interpret manufacturers' suggested recommendations for cleaning components	
		ability to recognize potential hazards	
		ability to clean holding tank and lines	
		ability to verify cleaning has been completed	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

32.08	Replaces defective components.	knowledge of techniques and procedures to replace air cleaner components	tool pouch, multimeter, ammeter, alignment tools
		knowledge of fundamentals of operation and types of air cleaning assembly components such as filters,	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		recirculating pump, heat exchanger, wiring and controls, washer nozzles and holding tank ability to interpret manufacturers' specifications, diagrams and instructions ability to select and operate tools and equipment ability to adjust components for application ability to test component/system and verify operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

32.09	Reassembles air cleaning assembly.	knowledge of reassembly sequences and techniques for air cleaning assemblies knowledge of manufacturers' designed operating conditions knowledge of rigging and hoisting techniques and procedures ability to interpret manufacturers' specifications, diagrams, procedures and adjustment operations ability to select and operate tools ability to reassemble components in sequential order ability to align, attach and secure components	tool pouch, electric drill, rigging equipment, hoisting equipment, alignment tools, multimeter, ammeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to verify operation of components and system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

Task 33 **Installs air cleaning assemblies.**

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
33.01	Removes packaging/ shipping materials.	knowledge of techniques and procedures for handling air cleaning assemblies knowledge of hoisting and rigging techniques and procedures ability to interpret manufactures' specifications, diagrams and instructions regarding the location and removal of shipping materials ability to unload material and/or equipment at assigned location ability to identify and report damages and/or shortages ability to dispose of waste materials	tool pouch, crow bar, utility knife

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	no	yes	yes	NV

33.02	Verifies air cleaning system specifications.	knowledge of electronic, air washer, filter, dry and viscous type air cleaner assemblies	

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of types of filters such as replaceable, manually-cleaned and automatically cleaned type filters	
	knowledge of ionizing and charged media type electronic filters	
	knowledge of types of pump units such as open or hermetic	
	ability to obtain and interpret application plans, specifications and shop drawings	
	ability to confirm specifications meet design and installation procedures	
	ability to confirm equipment and materials have been ordered	
	ability to confirm equipment on site corresponds to specified materials such as model number, serial number, size, phase, capacity and certification	
	ability to identify and report damages and/or shortages	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	no	yes	yes	NV

33.03	Mounts air cleaning assembly.	knowledge of techniques and procedures to mount air cleaning assemblies knowledge of types, sizes and capacities of air cleaning assemblies knowledge of layout, location of assembly and required clearances knowledge of equipment manufacturers' specifications	tool pouch, chain falls, crane, rigging equipment, lifts, staging, ladder, electric drill

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of hoisting and lifting procedures ability to position air cleaning assembly with regard to vibrations and flow direction	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	no	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
33.04	Aligns air cleaning assembly.	knowledge of techniques and procedures to align air cleaning assemblies knowledge of manufacturers' specifications ability to position assembly for required piping connections ability to adjust positioning of assembly for air flow, filtration service, control service and service access	tool pouch, rigging equipment, alignment tools

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	no	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
33.05	Levels air cleaning assembly.	knowledge of techniques and procedures to level air cleaning assemblies ability to interpret manufacturers' levelling instructions ability to make levelling adjustments to assembly	tool pouch, levels, alignment tools

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	no	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
33.06	Mounts controls and valves.	knowledge of types, sizes and capacities of controls and /or valves knowledge of techniques and procedures to mount controls and/or valves knowledge of layout, location of system and space requirements knowledge of wiring design and piping layout knowledge of installation codes ability to identify and select controls ability to interpret manufacturers' specifications, application drawings, blueprints and shop drawings ability to position and mount controls and/or valves in accessible location for operation ability to operate oxy-acetylene, turbo and propane torch kit ability to braze, solder, weld	tool pouch, electric drill, pipe threaders, flaring tools, tube cutters, torch kit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	no	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
33.07	Hooks up electric motor or power supply.	knowledge of techniques and procedures to hook up electric motors or power supply knowledge of power, voltage and phase requirements knowledge of required isolation device for power utilities	tool pouch, multimeter, voltmeter, ammeter, phase meter

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to conform to labelling requirements for power utilities	
	ability to interpret manufacturers' specifications, diagrams and instructions	
	ability to test for voltage, phase and overload protection and rotation	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	no	yes	no	NV

Task 34 Commissions air conditioning and heat pump systems.

Trend: Towards proper commissioning of heating, ventilation, air conditioning and refrigeration systems.

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.01	Reviews manufacturers' specifications for commissioning systems.	knowledge of types of air conditioning and heat pump systems, assemblies and components	
		knowledge of system operation including site and system location	
		ability to interpret manufacturers' specifications, diagrams and instructions	
		ability to identify required data and procedures to be followed and arrange tasks in sequential order	
		ability to interpret blueprints and shop drawings	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret electrical wiring diagrams and schematics	

NE	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.02	Checks utility sources.	knowledge of types of utilities such as gas, water, steam heat, oil and propane	tool pouch, multimeter, voltmeter, ammeter, pressure gauge
		knowledge of code requirements and operating specifications for utilities	
		knowledge of types, sizes and colour coding of wires	
		knowledge of test instruments such as multimeter, voltmeters, ammeter, pressure gauges	
		ability to interpret blueprints and specifications	
		ability to set up, calibrate and operate test equipment	

NE	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.03	Checks phase rotation.	knowledge of test instruments such as phase meter and ammeter	tool pouch, phase meter, ammeter, multimeter
		knowledge of impact of phase reversal on equipment such as damage to components, air and water movement and oil pressure	
		knowledge of damage to components such as air movement, oil pressure and water movement	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to identify rotation direction of components such as fans, pumps, compressors and motors ability to reverse rotation of components	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

34.04	Checks wiring.	knowledge of types, sizes and colour coding of wires knowledge of electrical testing equipment such as ammeter, voltmeters, multimeter, ohmmeter and megger knowledge of wiring defects such as shorts, grounds and opens ability to interpret manufacturers' specifications, charts, plans and schematics to verify wiring ability to set up, calibrate, operate and test instruments ability to identify loose, damaged, worn, discoloured and missing wires	tool pouch, ammeter, voltmeter, multimeter, ohmmeter, megger

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

34.05	Meggers motor.	knowledge of techniques and procedures to megger motors knowledge of test instruments such as meggers knowledge of manufacturers' specifications for motors such as	tool pouch, megger

	Sub-tasks	Enabling Objectives	Tools & Equipment
		resistance to ground and between phases knowledge of conditions for meggering motors such as temperature, humidity, pressure and the impact of each condition on the process ability to set up and operate meggers ability to identify lower resistance	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.06	Checks positions of isolation valves.	knowledge of types, sizes and capacities of isolation valves such as shut off and service knowledge of location of valves knowledge of system operation for valve positions during start up ability to interpret piping layout and drawings ability to operate test instruments such as pressure gauges ability to identify open and closed valves ability to interpret readings for valve position	tool pouch, pressure gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.07	Sets up economizer.	knowledge of system and its intended application such as minimum	tool pouch, multimeter, ammeter, velometer,

Sub-tasks	Enabling Objectives	Tools & Equipment
	ventilation requirements, mixed air temperatures and humidity	calculator, thermometer, psychrometer, pressure gauge
	knowledge of economizer system components, set up, sequence of operation and check out procedures	
	knowledge of types of controls associated with economizers such as actuators, mixed air temperature controls, enthalpy controls, change over temperature controls and return air temperature controls	
	knowledge of economizer control settings procedures	
	knowledge of manufacturers' specifications, diagrams and instructions	
	ability to operate testing equipment such as multimeter, ammeter, thermometer and pressure gauges	
	ability to set up and check out of economizer	
	ability to measure air flow with test instruments	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Sub-tasks	Enabling Objectives	Tools & Equipment
34.08 Sets up valve operation.	knowledge of system and its intended application such as minimum ventilation requirements, mixed air temperatures and humidity	tool pouch, pressure gauge, thermometer, voltmeter, potentiometer, multimeter
	knowledge of types and capacities of valves such as electric, electronic, pneumatic, automatic and manual valves and location of each	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of manufacturers' specifications knowledge of voltage, current and electrical codes knowledge of temperature pressure charts ability to interpret manufacturers' specifications, prints, schematics and tables ability to adjust valves ability to set up, calibrate and operate test equipment ability to interpret readings	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

34.09	Sets up variable inlet vanes.	knowledge of existing system and its intended application in regard to required static pressures knowledge of purpose and intended operation of variable inlet vanes knowledge of types of static pressure controllers and associated sensors knowledge of system static pressure operating parameters knowledge of variable inlet vane actuators such as pneumatic, electric and electronic ability to interpret manufacturers' specifications, diagrams and instructions regarding set up and check out of variable inlet vanes	tool pouch, pressure gauge, drill, pneumatic calibration kit, ammeter, multimeter, velometer, manometer, pitot tube

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to measure static pressure	

NE	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	NV

34.10	Conducts air balance.	knowledge of existing system and intended application in regard to physical layout, required airflows and space requirements knowledge of fan curves and duct design practices knowledge of techniques and procedures to conduct an air balance knowledge of allowable tolerances for specifications knowledge of acoustic noise levels and tolerances pertaining to duct, grille and diffuser systems knowledge of variable inlet vanes and variable volume terminal systems knowledge of air balance effects on system such as flow, temperature, pressure drop, noise and vibration knowledge of types of diffusers and grilles and manufacturers' "K" factors of each ability to interpret manufacturers' specifications, blueprints and mechanical drawings ability to calculate air balance ability to set up and operate test instruments	tool pouch, electric drill, vane anemometer, incline manometer, U-tube manometer, volumeter, hot wire anemometer, pitot tube, tachometer, multimeter, ammeter, deflecting vane aneometer, thermometer, psychrometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to perform measurements systematically according to designed system specifications ability to perform testing and analyze data	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	no	yes	no	NV

34.11	Sets up heating section.	knowledge of existing system and its intended application knowledge of types of heating sections such as propane fired, natural gas fired, oil fired, hot water and steam knowledge of types of safety and operating controls that service heating sections knowledge of fuel system and associated piping knowledge of venting systems knowledge of burner operation ability to interpret manufacturers' specifications and instructions regarding the required set up and check out of heating sections ability to interpret electrical diagrams and schematics ability to perform combustion analysis on flue gases	tool pouch, combustion analyzer, pressure gauge, thermometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to set up, calibrate and operate test instruments such as thermometers and pressure gauge	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.12	Sets up exhaust fans.	knowledge of existing system and its intended application knowledge of types of exhaust fans and associated controls ability to interpret manufacturers' specifications, diagrams and instructions ability to set up and operate test instruments such as multimeter and tachometer ability to check exhaust fans	tool pouch, tachometer, multimeter, ammeter, velometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.13	Sets up face and by-pass dampers.	knowledge of existing system and its intended application knowledge of controls associated with face and bypass damper systems ability to interpret manufacturers' specifications, diagrams and instructions regarding set up and check out of face and bypass dampers ability to set up and operate test instruments	tool pouch, velometer, thermometer, ammeter, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to check face and bypass dampers	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	no	yes	yes	no	NV

34.14	Adjusts humidification levels.	knowledge of existing system and its intended application in regard to designed humidity levels knowledge of types of humidity controls such as humidistat and dehumidistats ability to interpret electrical wiring diagrams and schematics ability to confirm calibration of humidity controls and sensors	tool pouch, psychrometer, thermometer, ammeter, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

34.15	Adjusts dehumidification levels.	knowledge of existing system and its intended application knowledge of types of humidity controls such as humidistat and dehumidistats ability to interpret electrical wiring diagrams and schematics ability to confirm calibration of controls and sensors	tool pouch, psychrometer, thermometer, ammeter, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.16	Checks condition of filter(s).	knowledge of existing system and its intended application knowledge of types and sizes of filters ability to determine required type and rating of filters ability to determine frequency of replacement or cleaning of filters ability to operate test instruments such as pressure gauges ability to check system and components for fouling and damage ability to check operation of automatic roll type filter systems	tool pouch, pressure gauge, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.17	Charges system.	knowledge of types of air conditioning and heat pump systems knowledge of techniques, procedures and instruments to leak test, pressure test, evacuate and charge system such as sight glass, superheat, liquid level, sub-cooling, frost line and weight method knowledge of charging equipment such as graduating cylinder, weigh scale, thermometer and pressure gauge knowledge of types of refrigerants such as ammonia, HFC, CFC and HCFC	tool pouch, graduated cylinder, pressure gauge, thermometer, weigh scale, oil pump, circulating pump, hydrometer, vacuum gauge, compound gauge, micron gauge, leak test instruments

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of secondary system refrigerants such as brine solutions, glycols and inhibitors knowledge of types, grades and applications of oil ability to interpret pressure temperature charts and charging charts ability to set up, calibrate and operate charging equipment ability to replenish refrigerants and refrigerant oils in primary and secondary applications ability to confirm charge ability to label system with refrigerant details	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

34.18	Starts up system.	knowledge of techniques and procedures to start up system(s) knowledge of types of air conditioning and heat pump systems and components knowledge of system operating parameters and manufacturers' specifications knowledge of types of test instruments such as multimeter and pressure gauges knowledge of electricity and electrical codes	tool pouch, pressure gauge, temperature gauge, multimeter, ammeter, thermometer, psychrometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to operate test equipment such as pressure and temperature gauge, ammeter and multimeter ability to recognize anomalies in start up through visual and auditory inspection ability to confirm operation is within specifications	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.19	Checks operating temperatures and pressures.	knowledge of system and its intended application in regard to required temperatures and pressures ability to interpret manufacturers' specifications and diagrams for operating temperatures and pressures ability to identify malfunctions such as leaks, overheating ability to operate testing equipment ability to verify operating temperatures and pressures	tool pouch, pressure gauge, thermometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.20	Sets superheats.	knowledge of system and its intended application in regard to required refrigerant, humidity, pressure and temperature knowledge of types of refrigerants such as ammonia, HFC, CFC and HCFC	tool pouch, pressure gauge, temperature gauge, thermometer, pressure temperature charts

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types of metering devices	
		ability to utilize pressure temperature checks to calculate superheats	
		ability to adjust metering devices to change superheat	
		ability to set up and operate test instruments	
		ability to verify superheats	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.21	Checks sub-cooling.	knowledge of system and its intended application in regard to recommended sub-cooling	tool pouch, thermometer, pressure gauge, pressure temperature charts
		knowledge of techniques and procedures to check sub-cooling	
		ability to interpret manufacturers' specifications, diagrams and schematics	
		ability to set up and operate test instruments and pressure gauges	
		ability to measure sub-cooling	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.22	Sets up operating and safety controls.	knowledge of system and its intended application in regard to humidity, pressure and temperature requirements	tool pouch, pressure gauge, thermometer, psychrometer, tachometer, velometer, multimeter, ammeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of system operating perimeters knowledge of types, locations and tolerance ranges of operating and safety controls knowledge of purpose and function of electrical, electronic and pneumatic air conditioning controls and control circuitry ability to interpret manufacturers' specifications, instructions, electric wiring diagrams, schematics and blueprints ability to set up and operate test equipment ability to test operating and safety controls ability to determines tolerance range for system controls ability to adjust operating and safety controls	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.23	Sets up heat reclaim/ recovery system.	knowledge of purpose and types of heat recovery systems such as heating of water and heating of air knowledge of safety and operating controls and devices required to operate heat recovery systems such as valves, relief devices, thermostats, solenoids and pressure temperature controls	tool pouch, pressure gauge, thermometer, psychrometer, multimeter, ammeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of existing system and its intended application in regard to limitation and supplemental requirements knowledge of types of heating sections such as propane fired, natural gas fired, oil fired, hot water and steam knowledge of types of safety and operating controls that service heating sections ability to interpret manufacturers' specifications, diagrams and instructions ability to set up and operate test equipment such as thermometer, psychrometer and multimeter	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

34.24	Verifies operation of purge unit system.	knowledge of system and its intended application knowledge of types of purge units such as manual, automatic, compressor and non-compressor operated knowledge of types of refrigerants knowledge of centrifugal compressor assembly knowledge of problems associated with non-condensibles in a centrifugal system	tool pouch, pressure gauge, thermometer, multimeter, ammeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret manufacturers' specifications, diagrams and instructions ability to set up and operate test equipment ability to perform operational check	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	no	no	yes	yes	yes	no	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.25	Checks defrost for heat pump systems.	knowledge of existing system and its intended application in regard to system refrigerants, required temperature, humidity and type of defrost knowledge of types of defrost such as condensing unit, electric defrost, hot gas defrost, reverse cycle and air defrost knowledge of operating and safety controls associated with defrost system ability to interpret manufacturers' instructions electrical wiring diagrams, schematics and blueprints ability to set up and operate test equipment such as thermometer, multimeter and ammeter ability to recognize advantages and disadvantages of defrost systems	tool pouch, pressure gauge, thermometer, multimeter, ammeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.26	Checks fluid levels.	knowledge of techniques and procedures to check fluid levels knowledge of existing system and its intended application knowledge of required levels of refrigerant, oil and water ability to interpret manufacturers' specifications, diagrams and instructions ability to visually inspect fluid levels ability to interpret devices such as sight glasses, receiver gauge and dip sticks	tool pouch, flow meter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

34.27	Checks voltage and amperage.	knowledge of voltage and amperage specifications and allowable tolerances knowledge of component rated voltage and amperage knowledge of allowable voltage and current unbalance ability to set up and operate test equipment such as voltmeters, multimeter and ammeters ability to conduct voltage check and interpret charts ability to identify voltage and amperage readings ability to calculate voltage and current unbalance	tool pouch, multimeter, ammeter, voltmeter, phase meter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to document readings	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.28	Checks motor drives.	knowledge of existing system and its intended application knowledge of types of drives such as belt and direct knowledge of required tolerances for belt and direct drive systems ability to interpret manufacturers' specifications, diagrams and instructions ability to check and align drives ability to set up and operate alignment tools ability to calculate and measure system component speeds	tool pouch, tachometer, calculator, alignment tools, multimeter, ammeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.29	Checks remote and in-house alarms.	knowledge of existing system and its intended application knowledge of types of remote and in-house alarms ability to interpret manufacturers' specifications, instructions, electrical wiring diagrams and schematics ability to operate computer terminal and printer	tool pouch, multimeter, ammeter, pressure gauge, thermometer, psychrometer, computer terminal, printer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to set up and operate test instruments	
		ability to interpret source and/or cause of individual system alarms	
		ability to determine the output or indication of each alarm	
		ability to visually or audibly confirm indication of each alarm	
		ability to test and reset alarm(s) and confirm operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.30	Labels equipment.	knowledge of required labelling for air conditioning and heat pump systems	labelling machine
		knowledge of company policies and procedures for labelling	
		knowledge of information to be included on labels	
		ability to clean area before installation	
		ability to position labels in designated areas of system/component	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.31	Completes start up report.	knowledge of information contained on start up report	
		knowledge of system start up procedures and sequences	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of manufacturers' recommended instructions on completion process ability to document start up information such as date, time, identification number and status of system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.32	Completes warranty cards.	knowledge of information contained on warranty cards knowledge of general periods of warranty for parts, components and systems ability to locate and identify parts, components and system information such as model number, serial number, manufacturer, voltage, phase, size, quantity and capacity ability to provide reason for part failure or request for warranty such as wrong part or broken parts ability to obtain original invoices and purchase orders to identify installation dates, identification numbers, manufacturer and supplier information ability to document information such as date, identification number, model and name of manufacturer	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
34.33	Instructs customer on system operation.	knowledge of system operation in each mode of operation and knowledge of location and identification of components within system ability to provide technical information to the customer ability to instruct customer on procedures for system shutdown and start up ability to explain system alarm details to customer and instructions to follow when alarm sounds ability to provide customer with necessary information such as system documentation, warranties, contact person and phone numbers	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	NV

BLOCK E SERVICE AND REPAIR OF REFRIGERATION AND AIR CONDITIONING SYSTEMS

Task 35 Detects refrigerant leaks.

Trend: Towards the elimination of ozone depleting refrigerants and towards mandatory scheduled leak testing.

	Sub-tasks	Enabling Objectives	Tools & Equipment
35.01	Obtains refrigerant handling certification.	knowledge of types of refrigerants such as ammonia, HFC, CFC and HCFC knowledge of refrigerant pressures knowledge of leak test methods ability to select and operate testing equipment ability to interpret pressure temperature charts ability to recover refrigerant in recovery units ability to record recovered refrigerant on inventory slips ability to meet government regulated entrance requirements for certification training course ability to successfully complete government regulated certification exam ability to update and renew certification requirements	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
35.02	Interprets remote electronic monitoring system data.	knowledge of types of refrigerant monitoring systems both on site and remote knowledge of system layout knowledge of monitoring devices knowledge of system application	tool pouch, computer terminal, printer, leak detector, multimeter, ammeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of customer or code allowable refrigerant leak rate	
		ability to interpret manufacturers' specifications, diagrams and instructions	
		ability to interpret fault codes and alarm signals	
		ability to access system reports to determine system history	
		ability to determine accuracy of system data	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

35.03	Identifies type of refrigerant.	knowledge of types of refrigerant, corresponding pressures and characteristic properties	tool pouch, thermometer, pressure gauge, pressure temperature charts
		knowledge of types of refrigerants such as ammonia, HFC, CFC and HCFC	
		ability to obtain refrigerant sample for analysis	
		ability to measure refrigerant pressure and corresponding temperature	
		ability to interpret refrigerant pressure and temperature charts and tables	
		ability to visually inspect nameplates of equipment/components to determine type of refrigerant	
		ability to recognize conditions of refrigerant during refrigeration cycle	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to identify refrigerant properties such as pressure, temperature, specific colour, density, enthalpy and entropy to distinguish refrigerants	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

35.04	Installs high/low side gauge.	knowledge of techniques and procedures for installing high/low side gauge	tool pouch, manifold pressure gauge
		knowledge of location of high/low side gauge	
		ability to identify high/low side	
		ability to calibrate gauges	
		ability to install and remove refrigerant high/low gauges with minimum refrigerant leakage	
		ability to attach gauges	
		ability to interpret pressure and temperature charts	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

35.05	Pressurizes system.	knowledge of techniques and procedures to pressurize system	tool pouch, manifold pressure gauge, nitrogen cylinder and regulator, carbon dioxide cylinder, pressure regulator
		knowledge of types of material used for pressurizing such as nitrogen and carbon dioxide	
		knowledge of high pressure gauges and regulators	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of system components and their pressure limitations	
		knowledge of system test pressure	
		knowledge of pressure settings of relief devices	
		knowledge of valve positions in order to determine gas flow	
		ability to interpret manufacturers' specifications and instructions to pressurize system	
		ability to operate nitrogen and carbon dioxide cylinder	
		ability to operate cylinder regulator	
		ability to obtain and control system test pressure	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

35.06	Inspects system visually.	knowledge of system and system components	tool pouch
		knowledge of common leak sources such as valve packing, flare joints, gasketed connections and capillary lines	
		ability to identify areas with collected oil and debris	
		ability to identify tripped valves or devices	
		ability to identify damaged components	
		ability to inspect system for corrosion	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to identify smoke type fumes for indication of ammonia leaks	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
35.07	Isolates portion of system to be tested.	knowledge of techniques and procedures to isolate portion(s) of system	tool pouch, manifold pressure gauge
		knowledge of system components and piping arrangement	
		knowledge of types of isolation valves	
		knowledge of valve positions such as open/closed	
		knowledge of system valve location and positions	
		knowledge of reactions of refrigerant flow to isolation	
		ability to activate valves to isolate refrigerant lines and/or components	
		ability to set up, calibrate and operate test instruments	
		ability to operate pressure gauge to monitor system pressures	
		ability to interpret pipe drawings	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
35.08	Conducts audible check of system.	knowledge of system and system components	stethoscope

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to use a stethoscope ability to recognize leak sounds such as hissing	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
35.09	Checks system for odours.	knowledge of system and system components knowledge of types of refrigerants and oils ability to recognize odours of refrigerant and oil such as ammonia	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
35.10	Performs halide torch test.	knowledge of system and system components knowledge of halide leak detectors knowledge of use of halide torch tests for refrigerants containing halogen ability to interpret flame colour to locate refrigerant leak ability to assemble halide torch using propane or acetylene as a fuel source	tool pouch, halide torch kit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
35.11	Performs electronic test.	knowledge of system and system components	tool pouch, electronic leak detectors

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types of electronic leak detectors knowledge of type of refrigerant leaks capable of being detected using electronic leak detectors ability to interpret manufacturers' operating specifications, diagrams and instructions for electronic leak detectors ability to set up, calibrate and operate electronic leak detector ability to interpret electronic leak detector alarms to locate leaks	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
35.12	Performs ultrasonic test.	knowledge of types of ultrasonic leak detectors knowledge of types of refrigerant leaks capable of being detected using ultrasonic leak detectors ability to interpret manufacturers' operating specifications, diagrams and instructions for ultrasonic leak detectors ability to set up, calibrate and operate ultrasonic leak detectors ability to interpret ultrasonic leak detector alarms to locate refrigerant leaks	tool pouch, ultrasonic leak detector

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
35.13	Performs leak test using soap solution.	knowledge of system and system components knowledge of leak detection methods knowledge of types of soap solutions ability to interpret manufacturers' instructions for applying soap solutions ability to recognize leaks	tool pouch, nitrogen cylinder and regulator, pressure gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

35.14	Performs leak test for ammonia using sulphur stick or litmus paper.	knowledge of ammonia reactions to sulphur sticks and litmus paper ability to apply litmus paper or sulphur sticks to suspected leak area ability to recognize changes in litmus paper or sulphur stick	tool pouch, litmus paper, sulphur stick

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

35.15	Performs leak test using submersion method.	knowledge of working pressure of component being tested ability to isolate component ability to calculate testing pressure ability to pressurize component and submerge in liquid ability to recognize bubbles to indicate leak	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
35.16	Performs dye penetrant test.	knowledge of system and system components knowledge of refrigerant types knowledge of amount of refrigerant contained in system ability to interpret manufacturers' specifications, diagrams and instructions for dye penetrant testing equipment ability to calculate required dye charge to be administered to system ability to operate ultraviolet lamps to detect leaks	tool pouch, manifold pressure gauge, ultrasonic leak detector, black light

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 36 Repairs refrigerant leaks.

Trend: Towards a greater concern for the environmental impact of refrigerants. Toward compliance of government regulations regarding the handling and recovery of refrigerants.

	Sub-tasks	Enabling Objectives	Tools & Equipment
36.01	Isolates leak.	knowledge of refrigeration systems and system components knowledge of manufacturers' recommended repair procedures ability to determine malfunction ability to shut down utilities	tool pouch, voltmeters, pressure gauge, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to close refrigeration system isolation valves	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

36.02	Determines cause and corrective action.	knowledge of system and system components knowledge of installation of system components knowledge of system operating pressures and refrigerant flows ability to determine if existing system conforms to normal installation practices ability to identify excessive corrosion, defective piping or components ability to recognize excessive vibration as possible cause of damage to piping or components ability to test for excessive system pressure ability to determine malfunction	tool pouch, manifold pressure gauge, multimeter, ammeter, torch kit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

36.03	Pumps down system.	knowledge of system and system components knowledge of types and operation of valves	tool pouch, manifold pressure gauge, multimeter, ammeter

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of location of isolation valves knowledge of receiver capacity to ensure system has sufficient pump down capacity knowledge of safety components and set points of relief devices ability to interpret electrical wiring diagrams and schematics ability to adjust valves to enable isolation and pump down ability to operate and interpret pressure gauges ability to determine when system should be pumped down	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Sub-tasks		Enabling Objectives	Tools & Equipment
36.04	Recovers refrigerant.	knowledge of types of refrigerants such as ammonia, HFC, CFC and HCFC and their composition knowledge of techniques and procedures to recover refrigerant knowledge of safety precautions when recovering refrigerant knowledge of recovery equipment such as recovery/recycle unit knowledge of CFC regulations knowledge of valve position within system knowledge of test instruments	tool pouch, recovery/ recycle unit, manifold pressure gauge, oil pump, weigh scale, pressure regulators

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to interpret refrigerant management instructions and refrigerant recovery codes and regulations ability to determine type and quantity of refrigerant to be removed ability to change oil and filter driers in recovery unit ability to operate recovery tank float level switches ability to operate weigh scales ability to set up and operate recovery/ recycle unit ability to monitor system pressures	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

36.05	Removes damaged pipe/ tubing section(s) and fittings.	knowledge of pipe/tubing removal techniques and procedures knowledge of system pressure at section being removed knowledge of heat tolerances for system components knowledge of weight and oil entrapment in pipes ability to operate pipe/tubing cutters ability to use heat suppression methods ability to operate oxy-acetylene torch kit and turbo torch kit	tool pouch, manifold pressure gauge, pipe cutting tools, torch kit, hacksaw

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to operate pipe/tubing cutters and brazing equipment	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
36.06	Installs new pipe/tubing section(s) and fittings.	knowledge of compatibility of pipe and fittings with system refrigerant and oil type knowledge of soldering, brazing, flaring and cutting techniques and procedures knowledge of pressure ratings of pipes/tubing and fittings knowledge of hoisting and rigging techniques and procedures ability to measure and cut pipe/tubing ability to operate pipe/tubing cutters ability to deburr pipe/tubing ability to select type and size of fittings and pipe/tubing ability to clean and prepare fittings and pipe/tubing ability to operate flaring, swaging and bending tools ability to thread pipe ability to operate nitrogen regulators and cylinders to purge piping/tubing ability to operate oxy-acetylene torch kit	tool pouch, bolt cutters, reamers, swaging tools, bending tools, flaring tools, pipe threaders, torch kit, nitrogen cylinder and regulator, hoisting equipment, rigging equipment

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to braze, solder and weld	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
36.07	Replaces gaskets, seals and O-rings.	knowledge of techniques and procedures to replace gaskets, seals and O-rings knowledge of types and sizes of gaskets, seals and O-rings knowledge of cleaning procedures for gaskets, seals and O-rings ability to interpret manufacturers' specifications, diagrams and instructions for components ability to select replacement gasket, seal and O-ring to match system component ability to torque bolts ability to clean and prepare surfaces of components ability to install gaskets, seals and O-rings	tool pouch, O-ring removal tool, scrapers, sandpaper, emery cloth, torque wrench

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
36.08	Repairs valves.	knowledge of techniques and procedures to repair valves knowledge of types of valves and their function knowledge of valve operation	tool pouch, packing tools, torque wrench

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to interpret manufacturers' valve diagrams, specifications and instructions ability to select required repair parts ability to dismantle and reassemble valves ability to install repair parts ability to adjust packings ability to torque bolts ability to confirm valve operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

36.09	Replaces valves.	knowledge of techniques and procedures to remove and replace valves knowledge of types of valves and their function knowledge of application and system in which valve is installed knowledge of valve pressure drop knowledge of hoisting and rigging procedures ability to interpret manufacturers' specifications, diagrams and instructions for valve replacement ability to braze and weld ability to dismantle and reassemble valves	tool pouch, multimeter, torch kit, tube cutters, reamers, flaring tools, nitrogen cylinder and regulator, pressure gauge, hoisting equipment, rigging equipment

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to select replacement valves	
		ability to install valve	
		ability to confirm valve operation	
		ability to adjust valve	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
36.10	Repairs condensers.	knowledge of types of condensers	tool pouch, torch kit, tube cutters, reamers, flaring tools, bending tools, swaging tools, nitrogen cylinder and regulator, manifold pressure gauge, leak detector, fin comb
		knowledge of techniques and procedures to repair condensers	
		knowledge of techniques and procedures to leak test condenser	
		ability to isolate condensers from system	
		ability to select and operate test instruments	
		ability to identify and access damage	
		ability to select required repair materials	
		ability to use nitrogen and regulator for purging	
		ability to braze, weld and solder	
		ability to straighten fins	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
36.11	Replaces condensers.	knowledge of techniques and	tool pouch, torch kit, tube cutters, reamers,

Sub-tasks		Enabling Objectives	Tools & Equipment
		procedures to remove and replace condensers	flaring tools, bending tools, swaging tools, nitrogen cylinder and regulator, manifold pressure gauge, hoisting equipment, rigging equipment
		knowledge of types of condensers	
		knowledge of condenser heat rejection capacity and material compatibility with system's refrigerant and oil	
		knowledge of application and system in which condenser is installed	
		knowledge of hoisting and rigging techniques and procedures	
		knowledge of secondary fluid flow through condenser	
		ability to interpret manufacturers' specifications, diagrams and instructions	
		ability to select replacement condenser	
		ability to braze and weld	
		ability to select and install replacement condenser	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

36.12	Repairs compressors.	knowledge of types of compressors such as screw, scroll, reciprocal, rotary and centrifugal	tool pouch, nitrogen cylinder and regulator, pullers, manifold pressure gauge, socket set, dial indicator, torque wrench
		knowledge of techniques and procedures to repair compressors	
		knowledge of lifting and hoisting techniques and procedures	

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of existing system and application knowledge of manufacturers' wear tolerances ability to interpret manufacturers' specifications, diagrams and instructions ability to test and identify compressor malfunctions ability to identify and select replacement parts ability to disassemble, repair and reassemble compressor ability to torque bolts ability to select, set up, calibrate and operate test instruments ability to isolate compressor from system ability to select replacement compressor ability to identify defective parts	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

36.13	Replaces compressors.	knowledge of techniques and procedures to remove and replace compressors knowledge of types of compressors and related components knowledge of hoisting and rigging techniques and procedures	tool pouch, socket set, oxy-acetylene torch kit, manifold pressure gauge, reamers, tube cutters, bending tool, swaging tool, welding kit, nitrogen cylinder and regulator, come-along, block and tackle

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to isolate and remove compressor from system ability to select replacement compressor and parts ability to torque bolts ability to align compressor drives ability to disconnect electrical wiring and controls ability to disconnect piping	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Sub-tasks	Enabling Objectives	Tools & Equipment
36.14 Repairs evaporators.	knowledge of manufacturers' techniques and procedures to repair evaporators knowledge of types of evaporators and their components ability to isolate evaporator from system ability to assess damage ability to braze, weld and solder ability to apply epoxy glue ability to use nitrogen cylinder and regulator ability to straighten fins	tool pouch, torch kit, manifold pressure gauge, reamers, tube cutters, bending tool, swaging tool, nitrogen cylinder and regulator, fin comb

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
36.15	Replaces evaporators.	knowledge of manufacturers' techniques and procedures to remove and replace evaporators knowledge of types of evaporators and their components knowledge of system in which evaporator is installed knowledge of secondary fluid flow through the evaporator knowledge of rigging and hoisting techniques and procedures ability to isolate evaporator from system ability to select replacement evaporator ability to braze, weld and solder ability to use nitrogen and regulator	tool pouch, torch kit, manifold pressure gauge, reamers, tube cutters, bending tool, swaging tool, nitrogen cylinder and regulator, come along, block and tackle

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

36.16	Repairs metering devices.	knowledge of manufacturers' techniques and procedures to repair and install metering devices knowledge of types of metering devices such as capillary tube, automatic expansion valve, thermostatic expansion valve and operated expansion valve, low and high pressure float valve pilot operated thermostatic expansion valve knowledge of system in which metering device is installed	tool pouch, thermometer, pressure gauge, multimeter, torque wrench, pressure temperature charts

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret charts, tables and schematics ability to select required repair parts ability to adjust metering device ability to measure superheat ability to torque bolts ability to isolate metering device from system ability to apply solvent ability to select components	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

36.17	Replaces metering devices.	knowledge of manufacturers' techniques and procedures to remove and replace metering devices knowledge of types of metering devices knowledge of system in which metering device is to be replaced knowledge of hoisting and rigging techniques and procedures ability to interpret charts, tables and schematics ability to remove metering device ability to select replacement metering device ability to torque bolts	tool pouch, multimeter, torch kit, manifold pressure gauge, tube cutters, reamers, flaring tools, nitrogen cylinder and regulator, thermometer, alignment tools, hoisting equipment, rigging equipment, torque wrench

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to adjust metering device ability to confirm operation ability to isolate metering device from system ability to braze, weld and solder ability to apply solvents ability to use nitrogen and regulator	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
36.18	Repairs receivers.	knowledge of system in which receiver is installed knowledge of material composition of receiver knowledge of pressure rating of receiver ability to interpret manufacturers' specifications, diagrams and instructions for repairing receivers ability to select required repair parts and materials ability to remove and replace sight glass ability to braze, weld and solder ability to apply epoxy glue ability to use nitrogen and regulator	tool pouch, torch kit, nitrogen cylinder and regulator, manifold pressure gauge, tube cutters, tube reamers, flaring tools, welding kit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
36.19	Replaces receivers.	knowledge of system in which receiver is installed knowledge of types of receivers knowledge of hoisting and rigging techniques and procedures ability to interpret manufacturers' specifications, diagrams and instructions for replacing receivers ability to remove receiver ability to select replacement receivers ability to braze, weld and solder ability to apply solvents ability to use nitrogen and regulator	tool pouch, torch kit, nitrogen cylinder and regulator, manifold pressure gauge, tube cutters, tube reamers, flaring tools, alignment tools

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
36.20	Repairs accessories.	knowledge of refrigeration system accessories such as drier cores, solenoid valves and coils, contactors, valves, timers and thermostats knowledge of system in which accessories are installed ability to interpret manufacturers' specifications, electrical wiring diagrams and instructions ability to select required repair parts and materials ability to set up, calibrate and operate test instruments ability to braze, weld and solder	tool pouch, torch kit, nitrogen cylinder and regulator, pressure gauges, multimeter, ammeter, thermometer, psychrometer, tube cutters, tube reamer, flaring tools, bending tools, test instruments

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to apply epoxy glue	
		ability to use nitrogen and regulator	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

36.21	Replaces accessories.	knowledge of types of refrigeration accessories such as drier cores, solenoid valves and coils, contactors, valves, timers and thermostats	tool pouch, torch kit, nitrogen cylinder and regulator, pressure gauge, multimeter, ammeter, thermometer, psychrometer, alignment tools, tube cutters, tube reamer, flaring tools, bending tools
		knowledge of system in which accessories are installed	
		ability to interpret manufacturers' specifications and instructions for replacing accessories	
		ability to interpret electrical wiring diagrams and schematics	
		ability to identify replacement accessories	
		ability to set up, calibrate and operate test instruments	
		ability to adjust accessories	
		ability to confirm operation of accessories	
		ability to braze, weld and solder	
		ability to apply epoxy glue	
		ability to use nitrogen and regulator	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
36.22	Performs leak test on piping system.	knowledge of system design and test pressures knowledge of component pressure tolerances knowledge of relief device locations and settings ability to identify type of refrigerant ability to select leak detection method and operate instruments ability to visually identify indications of refrigerant leaks such as oil, damaged lines or components ability to use vacuum pumps and micron gauge to indicate a system leak ability to employ inert gas to pressure up system ability to locate leak using soap test	tool pouch, manifold pressure gauge, pressure regulator, nitrogen cylinder and regulator, electronic leak detector, ultrasonic leak detector, litmus paper, sulphur stick, dye penetrant kit, halide torch kit, vacuum pump, micron gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

36.23	Performs pressure test.	knowledge of techniques and procedures to perform pressure test knowledge of system pressure limitations knowledge of use of nitrogen regulator knowledge of pressure test procedure codes and regulations	tool pouch, nitrogen cylinder and regulator, pressure gauge

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of manufacturers' recommendations and procedures for performing pressure tests ability to select and operate test instruments	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

36.24	Evacuates system.	knowledge of techniques and procedures to evacuate system knowledge of effects of temperature, electrical connections/power interruptions, line sizing on evacuation knowledge of evacuation safety procedures ability to interpret manufacturers' specifications and instruction to evacuate the system ability to use micron gauge and vacuum pump	tool pouch, vacuum pump, vacuum gauge, compound gauge, micron gauge, manometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

36.25	Recycles refrigerant.	knowledge of types of refrigerants knowledge of quantity of refrigerant in the system knowledge of techniques and procedures for handling refillable refrigerant cylinders ability to interpret manufacturers' specifications, diagrams and	tool pouch, manifold pressure gauge, weigh scale, oil pump, recovery/recycle unit

	Sub-tasks	Enabling Objectives	Tools & Equipment
		instructions for the set up and operation of refrigerant recovery unit	
		ability to operate weigh scales	
		ability to replace oil and filter driers in recovery units	
		ability to operate recovery unit to recover refrigerant	
		ability to check system for contamination	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
36.26	Recharges system.	knowledge of techniques and procedures for recharging system	tool pouch, multimeter, manifold pressure gauge, ammeter, charging cylinder, weigh scale, thermometer, psychrometer
		knowledge of types of refrigerants and their characteristic properties	
		knowledge of system application, layout and sequence of system operation	
		knowledge of system refrigerant capacity	
		ability to interpret manufacturers' specifications, diagrams and instructions for system charging	
		ability to install pressure gauges	
		ability to adjust valves	
		ability to charge system using sub-cooling, weight, sight glass and pressure chart procedures	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to monitor system pressures, temperatures and current to confirm charge and operation ability to select required refrigerant	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
36.27	Confirms system operation.	knowledge of techniques and procedures to confirm system operation knowledge of system application, layout and sequence of system operation knowledge of system requirements for temperature, humidity, pressures, voltage and current ability to interpret manufacturers' specifications, diagrams and instructions to confirm system operation ability to interpret pressure/ temperature chart ability to measure temperature, humidity, pressure, voltage and current to confirm system operation ability to visually confirm operation of system components, system equipment such as fans, gauges and sight glasses ability to perform system check using test instruments	tool pouch, manifold pressure gauge, voltmeter, thermometer, psychrometer, multimeter, ohmmeter, ammeter, pressure temperature charts

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 37 Performs refrigerant conversion.

Trend: Towards the conversion of systems using refrigerants containing CFC to comply with government regulations requiring the use of non-ozone depleting refrigerants.

	Sub-tasks	Enabling Objectives	Tools & Equipment
37.01	Determines feasibility of conversion.	knowledge of types of refrigerants	tool pouch
		knowledge of replacement refrigerants and their affect on other components in the system	
		knowledge of existing applications, design and layout	
		knowledge of amount of existing refrigerant	
		knowledge of system components, piping, lubricants and controls	
		knowledge of system components condition and age	
		knowledge of environmental impact of refrigerant containing CFC's	
		ability to identify replacement refrigerant for existing application	
		ability to determine system changes, component replacements and modifications	
		ability to calculate conversion cost to determine feasibility of conversion	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
37.02	Determines requirements for mechanical room modification.	knowledge of ventilation requirements for mechanical rooms knowledge of safety requirements ability to assess compatibility of equipment with replacement refrigerants	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

37.03	Selects replacement refrigerant.	knowledge of types and properties of refrigerants and their affects on system components knowledge of compatible refrigerant compressor oils ability to select refrigerant compatible to existing system design and layout	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

37.04	Determines component replacement requirements.	knowledge of refrigerants and their effects on components in the system knowledge of existing system application, refrigerant, oil, valves, and components knowledge of conversion refrigerant requirements such as capacity, metering device, compressor, oil and filter drier changes	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to select replacement components compatible with replacement refrigerants	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
37.05	Recovers existing refrigerant.	knowledge of storage requirements knowledge of government regulations for handling refrigerants knowledge of type and quantity of existing system refrigerant ability to interpret manufacturers' specifications, diagrams and instructions for the set up and use of recovery units and associated equipment ability to operate weigh scales ability to operate recovery/recycle unit ability to replace oil and filter driers in recovery units	tool pouch, manifold pressure gauge, recovery/recycle unit, weigh scale, oil pump

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
37.06	Replaces refrigerant oil.	knowledge of types and properties of refrigerants knowledge of types and quantity of replacement oil knowledge of types and viscosities of oils	tool pouch, pressure gauge, oil pump, refractometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to follow procedures for handling oils in order to limit contamination with moisture and air ability to operate oil pump for removal and installation of oils ability to flush refrigerant oil from system to reduce cross contamination with new oil ability to select oil for specific application ability to reduce pressure in compressor base in order to replace refrigerant oil	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

37.07	Replaces drier/drier core.	knowledge of types of driers and drier cores knowledge of existing type and quantity of driers/drier cores knowledge of flow direction for new driers/drier cores ability to select driers/drier cores that are compatible with new refrigerant ability to isolate or pump down area of system where driers/drier cores are located ability to dismantle and remove cores from drier shell ability to clean accumulated debris from drier shell ability to braze, solder and weld	tool pouch, cutting tool, reamers, cleaning materials, torch kit, manifold pressure gauge

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to cut and disconnect welded type driers	
		ability to install new driers/drier cores with minimal exposure to air and moisture	
		ability to isolate driers or drier shell in order to replace driers/drier cores	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
37.08	Replaces system components.	knowledge of types and functions of components such as O-rings, gaskets and seals	tool pouch, torch kit, manifold pressure gauge, multimeter, ammeter, alignment tools, tube cutters, tube reamers, flaring tools, nitrogen cylinder and regulator
		knowledge of installation procedures and adjustments that may be required for replacement components	
		ability to interpret manufacturers' specifications, diagrams and instructions for system component replacement	
		ability to select replacement components compatible with new refrigerants	
		ability to isolate components	
		ability to braze, weld and solder	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
37.09	Recharges with new refrigerant.	knowledge of types and properties of refrigerants such as ammonia, HFC, CFC and HCFC	tool pouch, multimeter, ammeter, pressure gauge, charging cylinder, weigh scale, thermometer,
		knowledge of system operation	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of refrigerant installation requirements ability to interpret manufacturers' specifications, diagrams and instructions for charging of systems ability to charge system using charging method such as sub-cooling, weight, sight glass and manufacturers' pressure temperature charts ability to set up and operate charging equipment ability to confirm charge	psychrometer, pressure temperature charts

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

37.10	Adjusts system metering device.	knowledge of types of metering devices knowledge of system operation knowledge of system application such as temperatures, pressures and humidity knowledge of superheat settings ability to interpret manufacturers' diagrams, specifications and instructions for adjusting metering devices ability to interpret pressure temperature charts ability to measure and calculate superheat ability to perform modifications	tool pouch, manifold pressure gauge, thermometers, psychrometers, temperature meter, pressure temperature charts

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to operate test instruments such as temperature meter and psychrometers	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
37.11	Replaces system metering device.	knowledge of types of metering devices knowledge of existing metering device and its ratings knowledge of installation requirements for metering device and sensitivity bulb ability to interpret manufacturers' specifications and instructions for the installation and setting of metering device ability to select replacement metering device compatible with new refrigerant and with comparable ratings for capacity and design ability to insulate sensitivity bulb ability to confirm operation of metering device ability to activate superheat ability to select replacement metering device ability to isolate metering device	tool pouch, multimeter, torch kit, manifold pressure gauge, alignment tools, tube cutters, reamers, flaring tool, nitrogen cylinder and regulator, thermometer, psychrometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
37.12	Adjusts system operating controls.	knowledge of types, purpose and function of system operating and safety controls knowledge of system and application requirements for new refrigerant such as humidity, pressure and temperature knowledge of system operating parameters knowledge of location of existing and new operating and safety controls ability to interpret manufacturers' specifications, diagrams and instructions for adjusting operating controls ability to interpret electrical diagrams, schematics and blueprints ability to interpret pressure temperature charts ability to select and operate test instruments such as temperature meter, voltage meter, pressure gauges ability to interpret gauge, thermometer and meter readings ability to adjust operating and safety controls ability to test and confirm operation of operating and safety controls	tool pouch, thermometer, temperature/pressure gauge, psychrometer, tachometer, velometer, multimeter, ammeter, pressure temperature charts

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
37.13	Labels refrigerant system.	knowledge of system operation knowledge of requirements for system labelling for conversion purposes ability to obtain specific labels ability to label information such as refrigerant type, refrigerant quantity, control set points and oil type and quantity	labelling machine

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

37.14	Analyzes refrigerant oil.	knowledge of types of refrigerant oil mixtures knowledge of oil reactions to changes in refrigeration system operation knowledge of procedures to determine oil mixtures knowledge of allowable cross contamination of types of oil in mixture knowledge of procedures to test oils for moisture and acidities knowledge of independent testing facilities ability to use test instruments such as refractometer, acid test kits	tool pouch, manifold pressure gauge, spectrometer, acid test kit, refractometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 38 Decommissions equipment.

Trend: Towards the removal of equipment using CFC refrigerants.

	Sub-tasks	Enabling Objectives	Tools & Equipment
38.01	Recovers existing refrigerant.	knowledge of types and properties of refrigerants knowledge of techniques and procedures to recover/recycle refrigerant knowledge of safety procedures and precautions when recovering refrigerant knowledge of types and sizes of recovery equipment knowledge of CFC regulations knowledge of system refrigerant type and quantity ability to interpret manufacturers' specifications, diagrams and instructions for decommissioning equipment ability to replace filter driers and oil in recovery unit ability to operate weigh scales and recovery unit ability to use piercing clamps	tool pouch, manifold pressure gauge, recovery/recycle unit, weigh scale, piercing clamps

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

38.02	Recovers refrigerant oil.	knowledge of system operation	tool pouch, manifold pressure gauge, oil pump, containers

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of refrigerant oils and their reaction with refrigerant ability to isolate compressor from the system ability to operate oil pumps ability to handle oil according to government regulations	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
38.03	Tags unit.	knowledge of government regulations to document unit as CFC free ability to tag units when oil has been removed ability to attach labels	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
38.04	Locks out utilities.	knowledge of electrical, gas and water utilities knowledge of utility switching or valving knowledge of local codes pertaining to tagging off utilities knowledge of location of primary and secondary utility shut offs ability to label system shut offs and their lock out condition	tool pouch, voltmeters, manifold pressure gauge, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
38.05	Seals lines.	knowledge of techniques and procedures to seal lines ability to seal open lines such as water, refrigerant, steam and propane ability to seal lines using brazing, welding, capping, soldering or plugging methods	tool pouch, torch kit, arc welder, pipe threaders

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
38.06	Pressurizes system components with nitrogen.	knowledge of system design knowledge of system components and their pressure limitations ability to operate nitrogen cylinder and regulators ability to operate regulators and safeties	tool pouch, pressure gauge, nitrogen cylinder and regulator

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 39 Diagnoses compressor malfunctions.

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
39.01	Inspects compressor for visible and audible symptoms of malfunction.	knowledge of techniques and procedures for inspecting compressors visibly and audibly	stethoscope, tool pouch

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of compressor malfunctions	
		ability to disassemble compressor	
		ability to visually inspect compressor for broken valves or broken rods, worn piston rings, wrist pins, bushing or crankshafts	
		ability to visually inspect compressor for seized oil pump, burn out, single phase or spot burn	
		ability to audibly inspect compressor for unusual noise	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

39.02	Checks functionality and output of electrical components.	knowledge of techniques and procedures for checking functionality and output of electrical components knowledge of types and capabilities of electrical components knowledge of power, voltage and phase requirements knowledge of shaft rotation and speed ability to interpret electrical wiring diagrams, schematics, charts and service manuals ability to visually inspect operation of controls and components ability to inspect electrical components for loose, worn or frayed electrical connections	tool pouch, voltmeter, multimeter, ammeter, pressure gauge, megger megohmmeter, tachometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to check electric motors ability to set up, calibrate and operate test instruments ability to interpret test results	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
39.03	Checks operating pressures and temperatures.	knowledge of techniques and procedures for checking operating pressures and temperatures knowledge of existing system and its intended application knowledge of design pressures and flow rates ability to set up, calibrate and operate test instruments and pressure gauges ability to interpret test results and pressure gauges	tool pouch, pressure gauge, thermometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
39.04	Checks capacity control system.	knowledge of existing system and its intended application knowledge of types of capacity controls such as actuators, safety controls and accessories knowledge of set up and operation of capacity controls knowledge of control system used to operate capacity control	tool pouch, multimeter, ammeter, pressure gauge, thermometers, voltmeters, manometer, milliamp meters

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of multi-speed motors ability to interpret manufacturers specifications, diagrams and instructions regarding capacity control set up and check out ability to interpret electrical wiring diagrams and schematics ability to calibrate electric, electronic and pneumatic flow controls and the valves actuated by them ability to set up, calibrate and operate test equipment such as pressure controls, thermostats, oil failure controls ability to verify valve and nozzle sizes meet system specifications ability to check capacity control by artificially varying system loads	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

39.05	Performs acid test/oil analysis.	knowledge of techniques and procedures to perform acid test/oil analysis ability to remove oil from compressor ability to contact outside sources to perform oil analysis chemical breakdown ability to operate and interpret manufacturers' moisture/acid test kits	tool pouch, pressure gauge, acid test kit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
39.06	Determines clean-up procedures of system.	knowledge of techniques and procedures to clean-up system knowledge of contaminant in system ability to interpret manufacturers' recommendation for clean up procedures ability to change oil and driers	tool pouch, pressure gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
39.07	Determines cause of failure.	knowledge of test procedures and techniques to determine cause of failure ability to identify source of common compressor malfunctions such as damaged shaft seal, compressor not starting or pumping ability to recognize damaged or broken valves ability to recognize incorrectly aligned belt drives and direct-drive	tool pouch, voltmeter, manifold pressure gauge, ohmmeter, multimeter, micrometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
39.08	Determines repair requirements.	knowledge of techniques and procedures for repairing compressors knowledge of components of the compressor such as belt drives, valves, seals and pump ability to perform efficiency check on compressor	

Sub-tasks		Enabling Objectives	Tools & Equipment
		ability to record compressor malfunctions ability to identify source of common compressor malfunctions such as damaged shaft seal, compressor will not pump, damaged or broken valves, incorrectly aligned belt drives, noisy compressor, compressor fails to start, incorrectly aligned direct-drive ability to determine length of time required for repair	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

39.09	Determines warranty status.	knowledge of service and system warranty limits such as time, and degree of reimbursement ability to locate and identify, parts, components and system model and serial numbers ability to determine compressor manufacturer and installation dates ability to provide reason for warranty request such as defective part and broken connections ability to contact manufacturer for warranty status requirements ability to obtain and complete warranty cards and warranty forms	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 40 Overhauls compressor assemblies.

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
40.01	Shuts down compressor including lock out.	knowledge of techniques, procedures and sequence to shut down and lock out compressors knowledge of types of compressor assemblies knowledge of site specific lock out requirements knowledge of types of utilities such as gas, water, steam heat, oil and propane knowledge of code requirements and operating specifications for utilities knowledge of energy sources in steam, hot water, gas and electricity knowledge of secondary components in series with isolation test that require prior shutdown ability to interpret manufacturers' specifications for shutting down compressor assemblies ability to mechanically lock out isolation devices and to label in sequence ability to identify locations of primary and secondary utility isolation devices such as electrical disconnects and breakers, oil, propane, natural gas and steam supply valves	tool pouch, padlock, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to confirm system shutdown and lock out prior to commencing repairs	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
40.02	Isolates compressor and electrical.	knowledge of manufacturers' techniques and procedures to isolate compressor and electrical knowledge of power, voltage and phase requirements knowledge of electrical and installation codes knowledge of operation of system components ability to identify system components ability to locate compressor isolation valves ability to lock out utilities ability to select and operate tools and test equipment	tool pouch, pressure gauge, voltmeter, multimeter, ammeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
40.03	Recovers refrigerants.	knowledge of types of refrigerants such as their composition knowledge of techniques and procedures to recover/recycle refrigerants	tool pouch, recovery/ recycle unit, manifold pressure gauge, oil pump, weigh scale, pressure regulators

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types and sizes of recovery equipment such as recovery/recycle unit	
		knowledge of CFC regulations	
		knowledge of valve position within system	
		knowledge of test instruments	
		ability to interpret refrigerant management instructions and refrigerant recovery codes and regulations	
		ability to determine type and quantity of refrigerant to be removed	
		ability to change oil and filter driers in recovery unit	
		ability to operate weigh scales	
		ability to set up and operate recovery equipment including tank float level switches	
		ability to monitor system pressures	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

40.04	Disassembles compressor.	knowledge of disassembly sequence	micrometers, megger
		knowledge of pipe connections and fittings	
		knowledge of dismantling techniques and procedures for compressors such as rotary, reciprocating, centrifugal and screw and their components, including capacity control system	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret manufacturers' prints, schematics, graphs, charts and tables ability to identify defective components ability to mark components for reassembly sequence ability to test compressor for wear using micrometers ability to measure insulation resistance ability to select and operate test instruments ability to lubricate components	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

40.05	Examines mechanical components for excessive wear and damage.	knowledge of operation of components knowledge of types of compressor valves including, ring plate, flexing disc and reed valves knowledge of compressor lubrication methods such as splash and/or force feed knowledge of types of unloading mechanism and control devices used on compressors, such as mechanical, hot gas by-pass, oil, suction, vane, and multiple speed ability to identify compressor malfunctions such as damaged shaft	tool pouch, micrometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		seal, faulty pump operation and compressor failure ability to recognize damaged or broken valves ability to recognize misaligned belt drives and direct-drive ability to operate micrometer ability to measure insulation resistance	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

40.06	Examines electrical components and wiring.	knowledge of electrical theory knowledge of specifications on electrical components ability to interpret wiring diagrams ability to operate voltmeter, ammeter, ohmmeter and megohmmeter ability to visually recognize electrical malfunctions ability to check electrical terminal block for loose electrical fittings and burns	tool pouch, voltmeter, ammeter, ohmmeter, megohmmeter, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

40.07	Arranges for mechanical components to be rebuilt.	knowledge of authorized compressor overhaul sources knowledge of compressor parts that can be rebuilt such as crankshafts	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to determine if part can be rebuilt	
		ability to assess overall condition of the compressor	
		ability to document wear tolerances	
		ability to determine if compressor should be returned for core credit	
		ability to price parts	
		ability to complete paperwork	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
40.08	Repairs mechanical components.	knowledge of operation of mechanical compressor components	tool pouch, thread sealer
		knowledge of types of compressor valves including, ring plate type valves, flexing disc or reed type valves	
		knowledge of compressor lubrication methods including fundamentals of operation of splash and/or force feed	.
		knowledge of types of unloading mechanism and control devices used on compressors, such as mechanical, hot gas by-pass, oil, suction, vane, and multiple speed	
		ability to repair/replace damaged or broken valves	
		ability to confirm mechanical component operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
40.09	Replaces mechanical components.	knowledge of manufacturers' techniques and procedures for replacing mechanical components knowledge of types and sizes of mechanical compressor components such as pistons, valves and connecting rods ability to interpret manufacturers' specifications, diagrams and instructions for replacing components ability to select replacement components such as pistons, valves, crankshaft and connecting rods to match manufacturers' model/serial numbers ability to clean and prepare surfaces of components ability to install gaskets, seals and O-rings	tool pouch, O-ring removal tool, alignment tools, scraper, grease gun, brushes

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

40.10	Repairs defective electrical wiring components or controls.	knowledge of techniques and procedures to repair defective electrical wiring components or controls ability to interpret electrical wiring diagrams and schematics ability to disconnect electrical wiring and controls	tool pouch, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
40.11	Replaces defective electrical wiring components or controls.	knowledge of techniques and procedures to replace defective electrical wiring components or controls such as stator, rotors and motor protectors knowledge of types, voltages, horsepower and manufacturer of electrical wiring components and controls for motors ability to interpret electrical wiring diagrams and schematics ability to disconnect electrical wiring and controls ability to select electrical wiring components and controls to match system	tool pouch, pullers, bolt cutter, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
40.12	Reassembles compressor.	knowledge of techniques and procedures to reassemble compressor knowledge of reassembly sequence knowledge of manufacturers' specifications for bolt torques ability to interpret manufacturers' specifications and instructions to reassemble compressor ability to test-run compressors to check oil pressures and amperages ability to recognize abnormalities in amperage, pressures and compressor sounds	tool pouch, leak detector, nitrogen cylinder and regulator, ammeter, pressure gauge, piston ring depressor, alignment tools, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to prepare compressor for inventory by sealing, leak checking, pressurizing with nitrogen, power washing, painting and re-tagging	
		ability to complete paper work for rebuilt compressor such as probable cause of failure, model and serial number, materials, time required and date of repair	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
40.13	Performs leak test on compressor.	knowledge of compressor and its components knowledge of system design and test pressures knowledge of component pressure tolerances knowledge of relief device locations and settings ability to identify type of refrigerant ability to select leak detection method and operate leak detectors ability to visually identify indications of refrigerant leaks such as oil, damaged lines or components ability to operate vacuum pumps and micrometer to indicate a system leak ability to employ inert gas to pressure up system ability to inspect gaskets and seals	tool pouch, halide torch kit, dye penetrant kit, electronic leak detector, air compressor and regulator, pressure gauge, nitrogen cylinder and regulator

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to perform refrigerant leak tests such as halide torch, soap solutions, dye penetrant system and electronic leak detector	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

Task 41 Installs compressor assemblies.

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
41.01	Removes shipping materials.	knowledge of techniques and procedures for handling compressors knowledge of manufacturers' procedures to remove shipping materials ability to unload material/equipment at assigned location ability to identify and report damages and or shortages ability to dispose of waste material ability to recognize the need to work in pairs when lifting heavy equipment or packaging	tool pouch, crowbar, utility knife

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
41.02	Verifies compressor specifications.	knowledge of functions of compressors in the system knowledge of types of reciprocating and centrifugal compressor assemblies knowledge of types of drives used with centrifugal compressors knowledge of cooling methods used on centrifugal compressors knowledge of types of screw compressor assemblies knowledge of hoisting and rigging techniques and procedures ability to interpret prints, diagrams and schematics ability to determine compatibility of compressor with system	tool pouch, hoisting equipment, rigging equipment

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

41.03	Mounts compressor.	knowledge of types, sizes and capabilities of compressors knowledge of hoisting and lifting procedures and devices knowledge of techniques and procedures to install and mount compressors knowledge of layout, location and space requirements of system knowledge of required clearances	tool pouch, hoisting equipment, rigging equipment

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types of drives used with reciprocating compressor assemblies	
		knowledge of cooling methods used on reciprocating compressors	
		knowledge of installation codes	
		knowledge of hoisting and rigging techniques and procedures	
		knowledge of screw compression assembly, mounting procedures, and piping layout	
		ability to interpret manufacturers' specifications and instructions for mounting compressors	
		ability to position compressor in accessible location for connections	
		ability to operate tools and equipment	
		ability to communicate using standard approved hand signals for hoisting and rigging	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
41.04	Aligns compressor.	knowledge of techniques and procedures to align compressor	tool pouch, alignment tools, dial gauge, level
		knowledge of manufacturers' specifications for aligning compressor	
		ability to position compressor allowing space for connections	
		ability to adjust system controls and/or valves	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to level compressor	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
41.05	Connects electric motor or power supply.	knowledge of power, voltage and phase requirements knowledge of basic electrical theory knowledge of conductors, insulators and horsepower knowledge of federal, provincial/territorial, municipal and general codes and standards affecting electrical hook ups of refrigeration and air conditioning systems knowledge of static electricity hazards knowledge of components of electrical circuit ability to operate grounding equipment ability to lock out and tag electrical equipment ability to interpret wiring diagrams and schematics	tool pouch, electric drill, ohmmeter, voltmeter, ammeter, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
41.06	Performs clean-up procedures (hermetic/centrifugal, semi-hermetic).	knowledge of types of refrigerant knowledge of filter/drier capacities	tool pouch, refrigerant recovery/recycle unit, touch kit

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret oil and refrigerant analysis reports ability to change oil/refrigerant ability to braze and weld ability to change filter/drier ability to determine maintenance schedule	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

41.07	Connects pipe/tubing including couplings and fittings for refrigerant, oil, water, steam, fuel and exhaust lines.	knowledge of techniques and procedures to connect pipes/tubing and fittings knowledge of system layout knowledge of types and sizes of piping/tubing, couplings and fittings ability to interpret manufacturers' specifications and instruction to connect piping/tubing ability to attach couplings and fittings ability to select and operate tools and test instruments ability to braze and weld	tool pouch, oxy-acetylene torch kit, turbo torch kit, welding kit, brazing equipment, nitrogen cylinder and regulator, tube cutter, reamers, pressure gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

41.08	Checks piping/tubing connections including couplings and fittings for refrigerant, oil, water,	knowledge of techniques and procedures to check piping/tubing connections	tool pouch

	Sub-tasks	Enabling Objectives	Tools & Equipment
	steam, fuel and exhaust lines.	knowledge of location of piping/ tubing connections knowledge of piping diagrams including codes and symbols ability to interpret blueprints, diagrams, schematics and specifications ability to visually and physically check piping/tubing connections, couplings and fittings to confirm connections, alignment and sealing ability to determine replacement needs ability to adjust connections including couplings and fittings	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

41.09	Tests leaks, refrigerant, oils and water lines.	knowledge of techniques and procedures to test leaks, refrigerant, oils and water lines knowledge of leak detection methods knowledge of system design, components and test pressures knowledge of component pressure tolerances knowledge of relief device locations and settings ability to identify type of refrigerant	tool pouch, halide torch kit, dye penetrant kit, electronic leak detector, air compressor and regulator, pressure gauge, nitrogen cylinder and regulator, micron gauge

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to visually identify indications of refrigerant leaks such as oil, damaged lines or components ability to select and operate leak detecting instruments ability to operate vacuum pumps and micron gauge to indicate a system leak ability to employ inert gas to pressure up system ability to inspect gaskets and seals ability to perform refrigerant leak tests such as halide torch, soap solutions, dye penetrant system and electronic leak detector	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
41.10	Evacuates non-condensibles from system.	knowledge of evacuation techniques and procedures knowledge of required vacuum readings and durations ability to interpret vacuum gauges to ensure evacuation and absence of any leaks and moisture ability to set up and operate pressure and micron gauge, vacuum pumps ability to replace vacuum pump oil ability to operate test instruments	tool pouch, vacuum pump, vacuum gauge, compound gauge, micron gauge, manometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 42 Diagnoses evaporator and defrost system malfunctions.

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
42.01	Inspects evaporator and defrost system for visible and audible malfunctions.	knowledge of types of evaporators used in refrigeration and air conditioning systems including construction features such as dry-expansion and flooded knowledge of common methods of defrosting such as off-cycle air defrost, electric defrost, reverse cycle, hot gas defrost, water spray knowledge of functions of evaporator in system knowledge of components of defrost systems such as defrost heater, defrost termination station ability to interpret prints, charts and schematics ability to recognize unusual noise	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

42.02	Checks functionality and output of electrical components.	knowledge of power, voltage, and phase requirements knowledge of types and capabilities of electrical components knowledge of electrical codes ability to interpret electrical wiring diagrams and schematics	tool pouch, voltmeter, ammeter, ohmmeter, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to select and operate test instruments	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
42.03	Checks operating temperatures, pressures and humidity.	knowledge of existing system and its intended application knowledge of design pressures and flow rates ability to interpret manufacturers' specifications, diagrams and instructions ability to visually inspect operation of controls and components ability to select, set up and operate test instruments	tool pouch, pressure gauge, thermometer, psychrometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
42.04	Checks defrost capacity and control system.	knowledge of common methods of defrosting such as off-cycle air defrost, electric defrost, reverse cycle, hot gas defrost, water spray knowledge of various controls that regulate coil frost accumulation knowledge of electrical codes ability to identify components of various defrost systems	tool pouch, voltmeter, ammeter, ohmmeter, thermometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to select and operate tools and test equipment	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

42.05	Verifies flow of refrigerant.	knowledge of existing system and its intended application ability to check pressure difference across the evaporator and defrost system to confirm flow ability to interpret sight glass reading ability to set up, calibrate and operate fluid flow instruments	flow meter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

42.06	Verifies air and fluid flow across evaporator coil.	knowledge of system operation knowledge of types of evaporators knowledge of types of fluid flow such as water, refrigerant and glycol ability to set up and operate test equipment such as pressure gauges, thermometers and hydrometer	tool pouch, pressure gauge, thermometer, hygrometer, hydrometer, flow meter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

42.07	Determines cause of failure.	knowledge of test procedures in order to determine cause of failure ability to identify source of common evaporator and defrost system	tool pouch, voltmeter, multimeter, ohmmeter, manifold pressure gauge

	Sub-tasks	Enabling Objectives	Tools & Equipment
		malfunctions such as ice build up on the evaporator, faulty defrost heater, defrost valve malfunction ability to recognize damaged or defective defrost heater, valves and time clocks ability to recognize defrost system malfunctions	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

42.08	Determines repair requirements.	knowledge of manufacturers' techniques and procedures for repairing evaporator and defrost system knowledge of components of evaporator and defrost system such as defrost timer, solenoid and expansion valves, thermostat, heaters, fins and valves ability to perform efficiency check on evaporator evaporation and defrost systems ability to inspect bond between fin and tubing, defrost timer and valves ability to check oil in the evaporator ability to perform pressure check	tool pouch, voltmeter, ohmmeter, ammeter, pressure gauge, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

42.09	Determines warranty status.	knowledge of service and system warranty limits such as time, and degree of reimbursement	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to locate and identify, parts, components and system model and serial numbers	
		ability to determine compressor manufacturer and installation dates	
		ability to provide reason for warranty request such as defective part and broken connections	
		ability to contact manufacturer for warranty status requirements	
		ability to obtain and complete warranty cards and warranty forms	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 43 Overhauls evaporator and defrost assemblies.

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
43.01	Shuts down evaporator and defrost including system lock out.	knowledge of techniques, procedures and sequence to shut down and lock out evaporator and defrost assemblies	tool pouch, padlock, multimeter
		knowledge of system and its layout	
		knowledge of types of evaporator and defrost assemblies	
		knowledge of site specific lock out requirements	
		knowledge of types of utilities such as gas and electricity	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of code requirements and operating specifications for utilities	
		ability to interpret prints, charts and schematics	
		ability to identify location of primary and secondary utility isolation devices such as refrigerant, water and brine valves, breakers and disconnects	
		ability to determine component isolation and sequence of isolation depending on extent of repair	
		ability to mechanically lock out isolation devices and label in order to prevent accidental tampering	
		ability to confirm system shutdown and lock out prior to commencing repairs	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

43.02	Isolates evaporator and defrost.	knowledge of techniques and procedures to isolate evaporator and defrost	tool pouch, pressure gauge, padlock, multimeter, ammeter
		knowledge of types and functions of valves	
		ability to operate tools	
		ability to disconnect defrosting apparatus	
		ability to flush and clean piping	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to isolate circulating pump using valves such as refrigerant, water, glycol and brine valves	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
43.03	Recovers refrigerant.	knowledge of types of refrigerants and their composition knowledge of techniques and procedures to recover/recycle refrigerant knowledge of CFC regulations knowledge of types and sizes of recovery cylinders such as recovery/recycle unit knowledge of valve position within system knowledge of test instruments ability to determine type and quantity of refrigerant to be removed ability to interpret management instructions and refrigerant recovery codes and regulations ability to change oil and filter driers in recovery unit ability to operate recovery system including tank float level switches ability to operate weigh scales ability to monitor system pressures	tool pouch, recovery/ recycle unit, manifold pressure gauge, oil pump, weigh scale, pressure regulators

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
43.04	Disassembles evaporator assemblies.	knowledge of evaporator assembly components such as fans, fins and tubing ability to interpret graphs, charts and schematics ability to identify defective components ability to select and operate tools ability to connect electric motors and defrost system components ability to connect pipe to refrigerant, drain and defrost lines ability to braze, weld and solder	tool pouch, pressure gauge, pipe cutter, torch kit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
43.05	Inspects evaporator and defrost components for damage or wear.	knowledge of techniques and procedures to inspect evaporator components such as fans, fins and tubing and defrost components such as timer, valves, thermostat and electric heaters knowledge of types of evaporator and defrost components ability to recognize unusual noise ability to visually inspect for corrosion and bent and broken pieces ability to recognize terminated timers, terminated temperature and pressure of defrost system	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
43.06	Selects replacement evaporator and defrost components.	knowledge of types of evaporators and components such as fans, fins, tubing and metering devices knowledge of defrost components such as heaters, valves and timers knowledge of operating principles and applications of multiple evaporator systems knowledge of evaporator requirements such as surface area, internal volume, circulation of the refrigerant, acceptable pressure drop, design temperature difference knowledge of construction differences in dry-expansion evaporators such as bare tube, plate surface and finned knowledge of construction features such as dry-expansion and flooded knowledge of system operation ability to select components according to system specification	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
43.07	Repairs evaporator and defrost components.	knowledge of types of evaporators and defrost components and their operation knowledge of operation of evaporator components such as fans, fins and tubing and defrost components such as timers, heaters and valves	tool pouch, torch kit, nitrogen cylinder and regulator, tube cutters, reamers, ammeter, voltmeter, soldering equipment, brazing equipment, thermometer, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of techniques and procedures to repair evaporator and defrost components	
		knowledge of brazing and soldering techniques	
		ability to select and operate required tools and test instruments	
		ability to replace fittings, defrost elements, fan blades and/or motors	
		ability to reverse fan rotation	
		ability to comb or realign fins	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

43.08	Replaces evaporator and defrost components.	knowledge of techniques and procedures to replace evaporator and defrost components	tool pouch, electric drill, saw, level, grease gun
		ability to replace fittings, defrost elements, hangers, fan blades and/or motors	
		ability to select and operate tools and equipment	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

43.09	Reassembles evaporator and defrost assemblies.	knowledge of techniques and procedures to reassemble evaporator and defrost assemblies	tool pouch, alignment tools, pipe cutters
		ability to interpret prints, charts and schematics	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to connect electric motors and defrost system components ability to adjust controls or timers to regulate coil frost accumulation ability to connect pipe to refrigerant, drain and defrost lines	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

43.10	Performs leak test on evaporator and defrost system.	knowledge of evaporator and defrost system and its components knowledge of evaporator and defrost system design and test pressures knowledge of component pressure tolerances knowledge of relief device locations and settings ability to identify type of refrigerant ability to visually identify indications of refrigerant leaks such as oil, damaged lines or components ability to select and operate leak detecting instruments and method ability to operate vacuum pumps and micron gauge to indicate a system leak ability to employ inert gas to pressure up system ability to inspect gaskets and seals ability to perform refrigerant leak tests such as halide torch, soap	tool pouch, halide torch kit, dye penetrant kit, electronic leak detector, air compressor and regulator, pressure gauge, nitrogen cylinder and regulator, vacuum pump, micron gauge

	Sub-tasks	Enabling Objectives	Tools & Equipment
		solutions, dye penetrant system and electronic leak detector	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

43.11	Arranges for re-certification as per local code.	knowledge of certification requirements for evaporators knowledge of codes applicable to the re-certification of evaporators knowledge of types, sizes and operation of evaporators ability to arrange for inspections and testing by authorized personnel	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	NV

Task 44 **Installs evaporator and defrost assemblies.**

Trend: Towards the use of more cost efficient systems.

	Sub-tasks	Enabling Objectives	Tools & Equipment
44.01	Removes shipping materials.	knowledge of techniques and procedures for handling evaporators knowledge of manufacturers' procedures to remove shipping materials ability to unload material/ equipment at assigned location	tool pouch, crowbar, utility knife

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to identify and report damages and/or shortages	
		ability to dispose of waste materials	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

44.02	Verifies evaporator and defrost specifications.	knowledge of types of evaporator assemblies such as forced and natural convection, liquid cooling and contact cooling	
		knowledge of construction features of evaporators in refrigeration and air conditioning systems such as dry-expansion and flooded	
		knowledge of functions of the evaporator in system	
		knowledge of operating principles and applications of single and multiple evaporator systems	
		knowledge of applications of multiple evaporator systems for single temperature, dual temperature, unbalanced cooling loads, and high and low humidity	
		knowledge of role of evaporator temperature difference between refrigerant and air in changing humidity conditions of area	
		knowledge of function, type and size of system on which chillers are used	
		knowledge of common methods of defrosting such as off-cycle air defrost, electric defrost, reverse cycle, hot gas defrost and water spray	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to identify components of defrost systems such as timers and heaters	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

44.03	Mounts metering device.	knowledge of techniques and procedures to mount metering devices knowledge of types of metering devices knowledge of space requirements knowledge of piping layout and drain facilities knowledge of types of fittings and sizes knowledge of refrigerant controls knowledge of temperature sensor location in relation to evaporator ability to recognize affect of varying load on metering devices ability to select and operate tools and test instruments	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

44.04	Mounts defrost unit.	knowledge of installation procedures and layouts for defrost systems knowledge of space requirements and mounting methods	tool pouch, electric drill

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of evaporator design including accessibility, drain facilities and piping layout	
		knowledge of installation codes	
		knowledge of sequence of operation of refrigeration system defrost cycles	
		ability to interpret circuit wiring diagrams	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

44.05	Connects metering device.	knowledge of techniques and procedures for connecting metering devices	tool pouch, torque wrench
		knowledge of operation of metering devices, evaporator pressure regulators and distributors	
		ability to interpret manufacturers' specifications and drawings for connecting metering devices	
		ability to torque bolts	
		ability to adjust metering devices	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

44.06	Connects piping/tubing.	knowledge of techniques and procedures to connect piping/tubing	tool pouch, tube cutters, reamers, bending tools, flaring tools, torch kit, pressure gauge
		knowledge of threading, welding and brazing techniques and procedures	
		ability to connect pipe/tubing to refrigerant lines, drain and defrost	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		lines according to pipe layout and installation instructions ability to select and operate tools	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
44.07	Hooks up electrical power.	knowledge of power, voltage and phase requirements knowledge of regulating controls for coil frost accumulation knowledge of basic electrical theory knowledge of conductors, insulators and horsepower knowledge of use of grounding equipment knowledge of lock out and tagging procedures for electrical equipment knowledge of federal, provincial/ territorial, municipal and general codes and standards for electrical hook ups of refrigeration and air conditioning systems knowledge of static electricity hazards knowledge of components of electrical circuit ability to adjust timer controls ability to determine voltage and current draw ability to interpret wiring diagrams and schematics	tool pouch, electric drill, voltmeter, ammeter, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to set up and operate test instruments	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
44.08	Performs leak test on evaporator and defrost systems.	knowledge of evaporator and defrost system and components knowledge of evaporator and defrost system design and test pressures knowledge of component pressure tolerances knowledge of relief device locations and settings ability to identify type of refrigerant ability to select leak detection method and operate leak detecting instruments ability to visually identify indications of refrigerant leaks such as oil, damaged lines or components ability to operate vacuum pumps and micron gauge to indicate a system leak ability to employ inert gas to pressure up system ability to inspect gaskets and seals ability to perform refrigerant leak tests such as halide torch, soap solutions, dye penetrant system and electronic leak detector	tool pouch, halide torch kit, dye penetrant kit, electronic leak detector, air compressor and regulator, pressure gauge, nitrogen cylinder and regulator, vacuum pump, micron gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
44.09	Evacuates evaporator system.	knowledge of techniques and procedures to evacuate system knowledge of effects of temperature, electrical connections/power interruptions, line sizing on evacuation knowledge of evacuation safety procedures ability to interpret manufacturers' specifications and instructions to evacuate evaporator system ability to operate micrometer ability to connect and operate vacuum pump	tool pouch, vacuum pump, vacuum gauge, compound gauge, micron gauge, manometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
44.10	Arranges for certification or re-certification.	knowledge of certification requirements for evaporator systems knowledge of codes applicable to the re-certification of evaporator systems knowledge of types, sizes and operation of evaporator systems ability to arrange for inspections and testing by authorized personnel	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	NV

Task 45 **Diagnoses air, water and evaporative condenser and cooling tower assembly malfunctions.**

Trend: Towards the collection of manufacturing specifications to assist in troubleshooting unit malfunctions.

	Sub-tasks	Enabling Objectives	Tools & Equipment
45.01	Shuts down/starts system.	knowledge of techniques, procedures and sequences to shut down and lock out evaporator condenser and cooling tower assemblies	tool pouch, pressure gauge, padlock, multimeter, ammeter
		knowledge of types of evaporator condensers and cooling tower assemblies	
		knowledge of volumetric efficiency, its calculation and application	
		knowledge of site specific lock out requirements	
		knowledge of code requirements and operating specifications for utilities	
		ability to interpret manufacturers' specifications for shutting down compressor assemblies	
		ability to mechanically lock out isolation devices and label in sequence	
		ability to identify locations of primary and secondary utility isolation devices such as electrical disconnects and breakers, oil, propane, natural gas and steam supply valves	
		ability to confirm system shutdown and lock out prior to commencing repairs	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
45.02	Inspects condenser and cooling tower assemblies.	knowledge of techniques and procedures for inspecting evaporator condenser and cooling tower assemblies knowledge of types, construction and applications of condenser assemblies such as air-cooled, water-cooled, evaporative-cooled knowledge of types, construction and applications of cooling tower assemblies ability to interpret manufacturers' prints diagrams and schematics ability to measure air flows, fluid flows and temperatures ability to measure fan motor and fluid pump amperage draw	tool pouch, pressure gauge, thermometer, flow meter, ammeter, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
45.03	Checks functionality and output of electrical components.	knowledge of types and capabilities of electrical components knowledge of power, voltage and phase requirements knowledge of shaft rotation and speed ability to interpret electrical wiring diagrams, codes, schematics, charts and fault trees ability to visually inspect operation of controls and components	tool pouch, ohmmeter, ammeter, voltmeter, multimeter, tachometer, phase meter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to select and operate test instruments	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
45.04	Checks operating temperatures, pressures and humidity.	knowledge of techniques and procedures for checking operating temperatures, pressures and humidity knowledge of existing system and its intended application knowledge of design pressures and flow rates ability to set up, calibrate and operate test instruments and pressure gauges ability to interpret manufacturers' performance charts	tool pouch, pressure gauge, thermometer, psychrometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
45.05	Checks capacity control system.	knowledge of techniques and procedures for checking capacity control system knowledge of existing system and its intended application knowledge of types of capacity controls knowledge of set up and operation of capacity controls knowledge of control system used to operate capacity control knowledge of multi-speed motors	tool pouch, multimeter, ammeter, pressure gauge

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret manufacturers specifications, diagrams and instructions for setting up and checking capacity control systems ability to check capacity control by varying system loads	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
45.06	Verifies flow of refrigerant.	knowledge of existing system and its intended application ability to check pressure difference across condenser and cooling tower to confirm flow ability to set up, calibrate and operate fluid flow instruments	flow meter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
45.07	Verifies air/fluid flow across condenser.	knowledge of types of fluid flow ability to set up and operate test equipment such as pressure gauges, thermometers and hydrometer	tool pouch, pressure gauge, thermometers, hydrometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
45.08	Verifies water flow through tower.	knowledge of flow measuring devices such as flow meters and flow versus pressure drop charts ability to interpret prints, schematics, graphs, charts and tables	flow meter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to determine fluid flows from sound, temperature and pressure drops	
		ability to interpret equipment performance charts	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

45.09	Tests water quality for cooling tower.	knowledge of test methods to determine water quality	water analysis kit, goggles, gloves
		ability to interpret charts and tables	
		ability to test water quality for contaminants such as algae or scale build-up	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

45.10	Determines cause of failure.	knowledge of testing techniques and procedures to determine cause of failure	tool pouch, manifold pressure gauge, voltmeter, ohmmeter, thermometer, multimeter
		ability to identify source of common air, water and evaporator condenser and cooling tower assembly malfunctions such as damaged fans, and pumps not starting or pumping	
		ability to recognize damaged or defective pumps and fan assemblies	
		ability to recognize incorrectly aligned belt drives and direct-drive couplings	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to recognize noisy components such as pumps and fans	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
45.11	Determines repair requirements.	knowledge of techniques and procedures for repairing air, water and evaporator condensers and cooling tower assemblies knowledge of components of evaporator and cooling tower assemblies such as pumps and fans ability to record malfunctions ability to recognize scope of repair ability to determine length of time required for repair	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
45.12	Determines warranty status.	knowledge of service and system warranty limits such as times, and degree of reimbursement ability to locate and identify, parts, components, system model and serial numbers ability to determine evaporator and cooling tower manufacturer and installation dates ability to provide reason for warranty request such as defective part and broken connections	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to contact manufacturer for warranty status requirements ability to obtain and complete warranty cards and warranty forms	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

Task 46 Overhauls condenser assemblies including air, water and evaporative condensers.

Trend: Towards the conversion of more energy efficiency components during repairs.

	Sub-tasks	Enabling Objectives	Tools & Equipment
46.01	Shuts down system including lock out.	knowledge of techniques, procedures and sequences to shut down and lock out condenser assemblies knowledge of system layout and site specific lock out requirements knowledge of types of condenser assemblies knowledge of volumetric efficiency, its calculation and application knowledge of code requirements and operating specifications for utilities ability to interpret manufacturers' specifications for shutting down condenser assemblies ability to mechanically lock out isolation devices and to label in sequence	tool pouch, padlock, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to identify locations of primary and secondary utility isolation devices such as electrical disconnects and breakers, oil, propane, natural gas and steam supply valves ability to confirm system shutdown and lock out prior to commencing repairs ability to label lock out isolation devices in sequence	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

46.02	Isolates condenser malfunctions.	knowledge of manufacturers' techniques and procedures to isolate condenser knowledge of operation of system components knowledge of systematic troubleshooting techniques knowledge of test instruments knowledge of condensing pressures and temperatures ability to interpret prints, charts and schematics ability to isolate fault using test instruments	tool pouch, pressure gauge, padlock, multimeter, ammeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
46.03	Recovers refrigerant in condenser.	knowledge of types of refrigerants such as ammonia, HFC, CFC and HCFC and their composition knowledge of techniques and procedures to recover/recycle refrigerant knowledge of types and sizes of recovery equipment such as recovery/recycle unit knowledge of CFC regulations knowledge of valve position within system knowledge of test instruments ability to determine type and quantity of refrigerant to be removed ability to interpret refrigerant management instructions and refrigerant recovery codes and regulations ability to change oil and filter driers in recovery unit ability to operate weigh scales ability to set up and operate recovery equipment including recovery tank float level switches ability to monitor system pressures	tool pouch, recovery/ recycle unit, manifold pressure gauge, oil pump, weigh scale, pressure regulators

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

46.04	Disassembles condenser.	knowledge of types of condensers such as air-cooled, water-cooled,	tool pouch, bearing puller, wheel puller

Sub-tasks	Enabling Objectives	Tools & Equipment
	refrigerant-cooled and evaporative-cooled	
	knowledge of techniques and procedures to disassemble condensers	
	knowledge of pipe connections and fittings	
	ability to interpret manufacturers' specifications, diagrams and instructions	
	ability to identify defective components such as fans, tubing and valves	
	ability to disassemble condenser components in sequential order	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

46.05	Inspects condenser components.	knowledge of functions and operation of condensers and receivers in system	tool pouch, thermometer, pressure gauge, flow meter
		knowledge of types of condenser components such as fans, tubing and valves	
		knowledge of methods used for low ambient control of condensing pressures and temperatures, condenser flooding, fan cycling and cooling towers	
		knowledge of safe handling procedures for acids and solvents used for cleaning air cooled and/or water cooled condensers	
		ability to interpret manufacturers' specifications	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to inspect condenser for scale, corrosion, erosion, wear, electrical and hardware failure, restrictive air flow	
		ability to select and operate measuring instruments for air temperature and flow, and water temperature and flow	
		ability to determine reason for changes to condensing pressures and temperatures, such as changes in refrigeration load, condensing medium flow, temperature of ambient condition and cooling water	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
46.06	Selects replacement condenser components.	knowledge of equipment capabilities and requirements	
		knowledge of electrical and installation codes	
		knowledge of types of condenser components such as fans, tubing and valves and their function	
		ability to interpret manufacturers' specifications and drawings	
		ability to select components according to system specifications	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
46.07	Repairs defective components.	knowledge of techniques and procedures to repair defective	tool pouch, pressure gauge, thermometer

Sub-tasks	Enabling Objectives	Tools & Equipment
	components such as fans, tubing and valves knowledge of types, sizes and capacity of condenser assemblies and components knowledge of operation of components ability to interpret manufacturers' specifications and instructions to repair defective components ability to repair condenser assemblies such as air cooled, water cooled, evaporative cooled, refrigerant cooled and cooling towers ability to identify components ability to select, calibrate and operate required tools and equipment ability to adjust components ability to lubricate components ability to verify operation of components after repair	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

46.08	Replaces defective components.	knowledge of techniques and procedures to remove and replace defective components knowledge of types, sizes and capacities of components ability to interpret manufacturers' specifications and instructions for replacing components	tool pouch, alignment tools, bolt cutters, electric drill

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to replace components such as fans, tubing and valves	
	ability to select, calibrate and operate tools and equipment	
	ability to secure fastening devices to replaced component	
	ability to match replacement components such as fans, tubing and valves to meet system requirements	
	ability to adjust component for designed operation	
	ability to lubricate component	
	ability to verify operation of replaced components	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Sub-tasks	Enabling Objectives	Tools & Equipment
46.09 Reassembles condenser.	knowledge of techniques and procedures for reassembling condensers	tool pouch, alignment tools, pipe cutter, pipe threader, pressure gauge
	knowledge of manufacturers' specifications, drawings and instructions for reassembling condensers	
	knowledge of sequencing for reassembling condensers	
	ability to interpret prints, charts and schematics	
	ability to connect pipes	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to select and operate tools	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
46.10	Performs leak test on system.	knowledge of condenser assemblies and their components knowledge of condenser design and test pressures knowledge of component pressure tolerances knowledge of relief device locations and settings ability to identify type of refrigerant ability to visually identify indications of refrigerant leaks ability to select leak detection method ability to select and operate leak detecting instruments ability to operate vacuum pumps and micron gauge to indicate a system leak ability to employ inert gas to pressure up system ability to inspect gaskets and seals	tool pouch, halide torch kit, dye penetrant kit, electronic leak detector, air compressor and regulator, pressure gauge, nitrogen cylinder and regulator, micron gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
46.11	Arranges for re-certification of condenser.	knowledge of certification requirements for condensers	

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of codes applicable to the re-certification of condensers	
	knowledge of types, sizes and operation of condensers	
	ability to arrange for inspections and testing by authorized personnel	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	NV

Task 47 **Installs condenser assemblies including air, water and evaporative condenser.**

Trend: Towards the use of more energy efficient models, designs and the reduction of noise through the use of quieter fans.

	Sub-tasks	Enabling Objectives	Tools & Equipment
47.01	Removes shipping materials.	knowledge of techniques and procedures for handling condensers	tool pouch, crowbar, utility knife
		knowledge of manufacturers' procedures to remove shipping materials	
		ability to unload material/ equipment at assigned location	
		ability to identify and report damages and or shortages	
		ability to dispose of waste material	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
47.02	Verifies condenser specifications.	knowledge of functions of condensers and receivers in the system including superheating, saturating and sub-cooling knowledge of types, sizes and capacities of condensers knowledge of space requirements for condensers knowledge of mounting and suspending methods for condensers and receivers such as air cooled, water cooled, evaporative cooled and refrigerant cooled knowledge of construction and function of receiver including applications, freezing and pressure relief protection knowledge of installation codes for condensers knowledge of data plate information knowledge of construction and application of condensers such as air cooled, including sub-cooling coils, evaporative including sub-cooling coils, water-cooled including double-tube, shell and coil, shell and tube condenser, refrigerant-cooled ability to interpret tables to establish operating head pressures	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

47.03	Mounts condenser.	knowledge of types, sizes and capabilities of condensers and condenser components	tool pouch, electric drill, ammeter, voltmeter, ohmmeter, hoisting

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of techniques and procedures to install and mount condensers	equipment, rigging equipment, multimeter
	knowledge of equipment manufacturers' specifications for mounting condensers	
	knowledge of piping layout including supply return and relief lines	
	knowledge of codes and regulations for mounting condensers and federal, provincial/territorial, municipal codes and standards for electrical hook ups of refrigeration and air conditioning systems	
	knowledge of hoisting and lifting procedures and devices	
	knowledge of required clearances	
	ability to interpret prints, diagrams and schematics	
	ability to position condenser in accessible location for connections	
	ability to communicate using standard approved hand signals for hoisting and rigging	
	ability to select and operate tools and test instruments	
	ability to interpret wiring diagrams	
	ability to identify electrical hazards	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
47.04	Connects pipe/tubing.	knowledge of techniques and procedures to connect pipes/tubing and fittings	tool pouch, tube cutters, reamers, bending tools, pipe threaders, torch kit, pressure gauge
		knowledge of system layout	
		knowledge of types and sizes of piping/tubing, couplings and fittings	
		ability to interpret manufacturers' specifications and instruction to connect piping/tubing	
		ability to attach couplings and fittings	
		ability to select and operate tools and test instruments	
		ability to braze and weld	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

47.05	Hooks up electrical power.	knowledge of power, voltage and phase requirements	tool pouch, electric drill, ohmmeter, voltmeter, ammeter, multimeter
		knowledge of basic electrical theory	
		knowledge of conductors, insulators and horsepower	
		knowledge of transformers	
		knowledge of use of grounding equipment	
		knowledge of lock out and tagging procedures for electrical equipment	
		knowledge of federal, provincial/territorial, municipal and general codes and standards affecting electrical hook ups of refrigeration and air conditioning systems	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of static electricity hazards knowledge of components of electrical circuit ability to interpret wiring diagrams and schematics ability to set up and operate test equipment	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	yes	NV

47.06	Performs leak test on system.	knowledge of condensers and their components knowledge of condenser design and test pressures knowledge of component pressure tolerances knowledge of relief device locations and settings ability to identify type of refrigerant ability to select leak detection method ability to visually identify indications of refrigerant leaks such as oil, damaged lines or components ability to select and operate leak testing instruments ability to operate vacuum pumps and micron gauge to indicate a system leak ability to employ inert gas to pressure up system	tool pouch, halide torch kit, dye penetrant kit, electronic leak detector, air compressor and regulator, pressure gauge, nitrogen cylinder and regulator, micron gauge

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to inspect gaskets and seals ability to perform refrigerant leak tests such as halide torch, soap solutions, dye penetrant system and electronic leak detector	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
47.07	Evacuates system.	knowledge of evacuation procedures knowledge of manufacturers' recommendations, techniques and procedures to evacuate system knowledge of effects of temperature, electrical connections/power interruptions, line sizing on evacuation knowledge of evacuation safety procedures ability to operate micron gauge ability to operate vacuum pump	tool pouch, vacuum pump, vacuum gauge, compound gauge, micron gauge, manometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
47.08	Arranges for certification of installation of condenser.	knowledge of certification requirements for condensers knowledge of codes applicable to the re-certification of condensers knowledge of types, sizes and operation of condensers	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to arrange for inspections and testing by authorized personnel	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	no	yes	yes	yes	NV

Task 48 **Installs cooling tower assemblies.**

Trend: Towards the increased use of sanitary cooling tower assemblies.

	Sub-tasks	Enabling Objectives	Tools & Equipment
48.01	Verifies cooling tower specifications.	knowledge of types of cooling tower assemblies such as natural draft, induced draft, forced draft, ejector and closed circuit coolers knowledge of components of cooling tower assemblies such as pump, piping, valves, basin, fan and driver motor, controls, spray nozzles and deck knowledge of operation of water pumps, piping, valves, wet sump, dry sump, fan and drive motors, controls, spray nozzles and deck and air eliminators knowledge of pump unit construction such as open or hermetic knowledge of open belt and open direct driven units knowledge of power, voltage and phase requirements knowledge of electrical codes	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret prints, diagrams and schematics	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

48.02	Mounts cooling tower assemblies.	knowledge of techniques and procedures to mount cooling tower assemblies knowledge of types of cooling tower assemblies knowledge of space requirements knowledge of ventilation requirements knowledge of quality and availability of water supply knowledge of piping layout and drain facilities knowledge of types of fittings and sizes knowledge of refrigerant controls knowledge of air flow and prevailing winds knowledge of installation codes and regulations knowledge of piping procedures for water distribution circuits, circulating and make-up water, drain, by-pass, bleed knowledge of fundamentals of capacity control of cooling tower	tool pouch, sockets, hoisting equipment, rigging equipment

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of rigging and hoisting techniques and procedures and signals	
		ability to interpret piping layout diagrams	
		ability to regulate flow of cooling media by adjusting by-pass/ regulating valve, water temperature control, damper controls	
		ability to select and operate tools and test equipment	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
48.03	Levels cooling tower.	knowledge of levelling techniques and procedures	tool pouch, bubble level, line level, precision level, hydraulic jacks, alignment tools
		knowledge of manufacturers' specification, diagrams and instructions to level circulating pump	
		ability to select levelling devices	
		ability to align, position and adjust cooling tower	
		ability to set up and operate levelling devices	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
48.04	Connects control valves.	knowledge of techniques and procedures to connect control valves	tool pouch
		knowledge of function and operation of flow control valves	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of piping practices ability to interpret piping drawings and diagrams	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
48.05	Connects electric motors and pumps.	knowledge of power, voltage and phase requirements knowledge of electrical codes knowledge of components of induction motors knowledge of operation, construction and application of motors and pumps knowledge of sequencing to start and run motors knowledge of transformer action between stator and rotor knowledge of function of capacitors knowledge of piping practice ability to identify types of single-phase and poly-phase induction motors ability to interpret wiring and piping diagrams	tool pouch, ohmmeter, voltmeters, ammeter, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
48.06	Connects piping/tubing.	knowledge of techniques and procedures to connect piping/tubing	tube cutters, reamers, bending tools, pipe

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types, sizes and capacities of tubing and piping knowledge of welding and brazing techniques and procedures ability to interpret drawings, prints and instructions for connecting piping ability to solder, braze and weld ability to select and operate tools and test instruments	threaders, torch kit, pressure gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

48.07	Mounts chemical metering devices.	knowledge of techniques and procedures for mounting chemical metering devices knowledge of water treatment and chemical additives knowledge of types of chemical metering devices such as drip tube, pressure injection and immersion ability to interpret charts ability to measure water quality	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

48.08	Connects chemical metering devices.	knowledge of techniques and procedures for connecting chemical metering devices	tool pouch, water analysis kit

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types of chemical metering devices such as drip tube, pressure injection and immersion knowledge of chemical treatment methods ability to interpret manufacturers' specifications and instructions for chemical metering devices ability to operate tools and equipment	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

48.09	Hooks up electrical power.	knowledge of power, voltage and phase requirements knowledge of electrical theory knowledge of conductors, insulators and horsepower knowledge of transformers knowledge of use of grounding equipment knowledge of lock out and tagging procedures for electrical equipment knowledge of federal, provincial/ territorial, municipal and general codes and standards affecting electrical hook ups of refrigeration and air conditioning systems knowledge of static electricity hazards knowledge of components electrical circuits	tool pouch, electric drill, ohmmeter, voltmeter, ammeter, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret wiring diagrams and schematics	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
48.10	Performs leak test on system.	knowledge of system and its components knowledge of system design and test pressures knowledge of component pressure tolerances knowledge of relief device locations and settings ability to identify type of refrigerant ability to select leak detection method ability to visually identify indications of refrigerant leaks such as oil, damaged lines or components ability to select and operate leak testing instruments ability to operate vacuum pumps and micron gauge to indicate a system leak ability to employ inert gas to pressure up system ability to inspect gaskets and seals ability to perform refrigerant leak tests such as halide torch, soap	tool pouch, halide torch kit, dye penetrant kit, electronic leak detector, air compressor and regulator, pressure gauge, nitrogen cylinder and regulator, micron gauge

Sub-tasks	Enabling Objectives	Tools & Equipment
	solutions, dye penetrant system and electronic leak detector	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

Task 49 **Overhauls cooling tower assemblies.**

Trend: Towards the increased use of energy efficient components such as motors and tower media fill grid.

	Sub-tasks	Enabling Objectives	Tools & Equipment
49.01	Shuts down system.	knowledge of techniques, procedures and sequence to shut down and lock out cooling towers knowledge of system and its layout knowledge of types of cooling tower assemblies knowledge of volumetric efficiency, its calculation and application knowledge of site specific lock out requirements knowledge of code requirements and operating specifications for utilities ability to interpret manufacturers' specifications for shutting down compressor assemblies ability to mechanically lock out isolation devices and label in sequence ability to identify locations of primary and secondary utility isolation	tool pouch, pressure gauge, padlock, multimeter, ammeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		devices such as electrical disconnects and breakers, oil, propane, natural gas and steam supply valves	
		ability to confirm system shutdown and lock out prior to commencing repairs	
		ability to label lock out isolation devices in sequence	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
49.02	Disassembles cooling tower.	knowledge of techniques, procedures and sequence to disassemble cooling towers	tool pouch, electric drill, electric hammer, sockets
		knowledge of pipe connections and fittings	
		ability to interpret prints, schematics, graphs, charts and tables	
		ability to identify defective components	
		ability to mark components for reassembly sequence	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
49.03	Inspects water tower components.	knowledge of techniques and procedures for inspecting water tower components	tool pouch
		knowledge of functions of water tower components such as pump, piping, valves, basin, fans, driver motor, controls and spray nozzles	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types of water tower components such as pumps, valves, controls and nozzles ability to interpret manufacturers' specifications and instructions for inspecting water tower components ability to visually inspect water tower components for malfunctions	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

49.04	Selects replacement components.	knowledge of fundamentals of operation and design of cooling towers knowledge of types and functions of cooling tower assembly components such as pump, piping and valves, basin, fan and drive motor, controls, spray nozzles and decks knowledge of natural draft, induced draft and forced draft knowledge of electrical and installation codes ability to match replacement components to existing system ability to determine if component repair or replacement is feasible	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

49.05	Repairs components.	knowledge of techniques and procedures to repair defective components	tool pouch, electric drill, ohmmeter, voltmeter,

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of power voltage and phase requirements knowledge of electrical code and safety precautions knowledge of manufacturers' specifications and instructions for repairing components knowledge of repair methods ability to select media fill to increase energy efficiency ability to drain and flush assembly ability to select and operate tools and test instruments	ammeter, hoses, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
49.06	Replaces components.	knowledge of techniques and procedures to remove and replace defective components knowledge of types, sizes and capacities of components knowledge of power voltage and phase requirements knowledge of electrical codes and safety precautions knowledge of manufacturers' specifications and instructions to replace components ability to select media fill to increase energy efficiency	tool pouch, electric drill, electric hammer, ohmmeter, voltmeter, ammeter, alignment tools, multimeter

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to select and operate tools and test instruments	
	ability to select method of repair	
	ability to drain and flush assembly	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

Sub-tasks	Enabling Objectives	Tools & Equipment
49.07 Reassembles cooling tower.	knowledge of techniques and procedures for reassembling cooling tower	tool pouch, alignment tools, drills, socket set, hose
	knowledge of water treatment and chemical additives	
	knowledge of manufacturers' specifications for reassembling cooling towers	
	knowledge of start up and shut down procedures	
	knowledge of make-up water and bleed rate	
	knowledge of water pump operation	
	knowledge of types and sizes of components and their function	
	ability to connect components and make required adjustment	
	ability to clean, drain and flush tower	
	ability to select chemicals and additives to prevent corrosion, algae or scale build-up	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
49.08	Tests towers for water leaks.	knowledge of cooling tower and its components	tool pouch
		knowledge of cooling tower design and test pressures	
		knowledge of component pressure tolerances	
		knowledge of relief device locations and settings	
		ability to select leak detection method	
		ability to select and operate leak testing instruments	
		ability to inspect gaskets and seals	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

Task 50 **Diagnoses system accessory malfunctions.**

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
50.01	Starts and shuts down system.	knowledge of techniques, procedures and sequences to start up and shut down system	tool pouch, pressure gauge, multimeter, ammeter
		knowledge of system and its layout	
		knowledge of types of system accessories	
		knowledge of code requirements and operating specifications for utilities	

ability to interpret manufacturers' specifications for shutting down system

ability to identify locations of primary and secondary utility isolation devices such as electrical disconnects, breakers, oil, propane, natural gas and steam supply valves

ability to confirm system shutdown prior to commencing repairs

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

50.02 Reviews design specifications against accessory application.

knowledge of types of system accessories and their individual components such as vibration eliminators, discharge mufflers, crankcase heaters, receivers, heat exchangers, suction line accumulators, suction line filters and driers, strainers, liquid and moisture indicators, desiccants, oil separators and valves

knowledge of manufacturers' specifications, diagrams and instructions for component accessories

knowledge of installation techniques procedures for types of system accessories

knowledge of intended system application

knowledge of system tolerances such as pressures, temperatures, humidity and noise levels

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of piping design for types of refrigerant piping such as liquid line, discharge line, hot gas line and oil line	
		ability to interpret blueprints and diagrams	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

50.03	Conducts visual inspection.	knowledge of system and system components	tool pouch
		knowledge of common leak sources such as indications of oil, and debris at valve packings, gaskets, relief valves, seals and expansion valves	
		ability to detect excessive component or line vibration	
		ability to visually identify tripped valves or devices	
		ability to visually inspect system accessories for corrosion	
		ability to visually identify smoke type fumes for indication of ammonia leaks	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

50.04	Checks functionality and output of electrical components.	knowledge of types and capabilities of electrical components	tool pouch, ohmmeter, voltmeter, ammeter, multimeter, tachometer, phase meter
		knowledge of power, voltage and phase requirements	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of shaft rotation and speed ability to interpret electrical wiring diagrams, schematics, charts, service manuals and fault trees ability to visually inspect operation of controls and components ability to inspect electrical components for loose, worn or frayed electrical connections ability to select, calibrate and operate test instruments ability to interpret test results	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
50.05	Checks functionality and output of mechanical components.	knowledge of operation of mechanical components knowledge of types and capabilities of system mechanical components ability to interpret manufacturers' specifications and instructions ability to identify system accessory malfunctions ability to recognize damaged or defective valves ability to recognize misaligned belt drives and direct-drive couplings	tool pouch, alignment tools

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
50.06	Checks operating temperatures and pressures.	knowledge of existing system and its intended application knowledge of design pressures and flow rates ability to set up, calibrate and operate test instruments and pressure gauges	tool pouch, thermometer, pressure gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

50.07	Verifies flow of refrigerant.	knowledge of existing system and its intended application ability to check pressure difference across system accessories to confirm flow	pressure gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

50.08	Determines cause of failure.	knowledge of system and its layout knowledge of test procedures to determine cause of failure ability to identify source of common system accessory malfunctions such as blocked orifices and damaged capillary line ability to recognize damaged or broken valves ability to recognize incorrectly aligned belt drives and direct-drive coupling	tool pouch, ammeter, ohmmeter, pressure gauge, thermometer, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
50.09	Determines repair required.	knowledge of techniques and procedures to repair system accessories knowledge of types of system accessories and their components ability to interpret manufacturers' specifications and recommendations ability to isolate system accessory from system ability to assess damage ability to select required repair materials	tool pouch, micrometer, calipers, pressure gauge, thermometers

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

50.10	Determines warranty status.	knowledge of service and system warranty limits such as time, and degree of reimbursement ability to locate and identify, parts, components and system model and serial numbers ability to determine system accessory manufacturer and installation dates ability to provide reason for warranty request such as defective part and broken connections ability to contact manufacturer for warranty status requirements ability to obtain and complete warranty cards and warranty forms	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

Task 51 Overhauls system accessories.

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
51.01	Shuts down system including lock out.	knowledge of techniques, procedures and sequences to shut down and lock out system	tool pouch, padlock, multimeter
		knowledge of system and its layout	
		knowledge of types of system accessories	
		knowledge of site specific lock out requirements	
		knowledge of code requirements and operating specifications for utilities	
		ability to interpret manufacturers' specifications for shutting down system	
		ability to mechanically lock out isolation devices and to label in sequence	
		ability to identify locations of primary and secondary utility isolation devices such as electrical disconnects and breakers, oil, propane, natural gas and steam supply valves	
		ability to confirm system shutdown and lock out prior to commencing repairs	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

51.02	Isolates accessories.	knowledge of techniques and procedures to isolate accessories	tool pouch, pressure

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types of system accessories and their individual components such as vibration eliminators, discharge mufflers, crankcase heaters, receivers, heat exchangers, suction line accumulators, suction line filters and driers, strainers, liquid and moisture indicators, desiccants, oil separators and valves knowledge of temperature and pressure controls ability to identify malfunctioning accessories	gauge, padlock, multimeter, ammeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

51.03	Recovers refrigerant.	knowledge of types of refrigerants such as ammonia, HFC, CFC and HCFC knowledge of techniques and procedures to recover refrigerant knowledge of procedures for filling recovery cylinders knowledge of types of recovery equipment such as recovery/recycle unit and recovery tank float level switches knowledge of CFC regulations knowledge of valve position within system knowledge of test instruments ability to determine type and quantity of refrigerant to be removed	tool pouch, recovery/ recycle unit, manifold pressure gauge, oil pump, weigh scale

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret refrigerant management instructions and refrigerant recovery codes and regulations	
		ability to change oil and filter driers in recovery unit	
		ability to operate recovery system and tank float level switches	
		ability to select and operate weigh scales	
		ability to monitor system pressures	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
51.04	Disassembles accessories.	knowledge of techniques and procedures to disassemble system accessories	tool pouch
		knowledge of purpose, types and location of system accessories	
		knowledge of sequencing for disassembling accessories	
		ability to interpret manufacturers' specifications, diagrams and instructions	
		ability to identify defective components	
		ability to select and operate tools and equipment	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
51.05	Inspects components.	knowledge of techniques and procedures to inspect components knowledge of component malfunctions knowledge of manufacturers' specifications ability to identify damaged or defective components ability to identify worn, corroded or frayed wires ability to identify seized valves	tool pouch, micrometer, calipers, pressure gauge, thermometers

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
51.06	Selects replacement components.	knowledge of manufacturers' specifications for replacement components knowledge of types and sizes of system components such as vibration eliminators, discharge mufflers, crankcase heaters, receivers, heat exchangers, suction line accumulators, suction line filters and driers, strainers, liquid and moisture indicators, desiccants, oil separators and valves knowledge of component compatibility with existing system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
51.07	Repairs system accessories.	knowledge of techniques and procedures to repair system accessories knowledge of types of system accessories knowledge of operation of system accessories ability to interpret manufacturers' diagrams, specifications and instruction for repairing system accessories ability to select required repair parts ability to install repaired accessories ability to confirm system accessory operation	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
51.08	Replaces system accessory components.	knowledge of replacement techniques and procedures for water regulating valves knowledge of directional flow, head pressure adjustment and repair kit installation knowledge of sizes and types of filter driers knowledge of replaceable core pressure drop and oil separators knowledge of operating temperature knowledge of high and low side pressure regulating valves	tool pouch, thermometer, manifold pressure gauge

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of relief devices and fire line procedures	
		knowledge of applicable codes	
		ability to interpret prints, diagrams and schematics	
		ability to determine size and type of component such as replacement core	
		ability to troubleshoot high and low side pressure regulating valves	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

51.09	Reassembles accessories.	knowledge of techniques and procedures to reassemble accessories	tool pouch, bolt cutter, ammeter, pressure gauge, alignment tools, multimeter, torque wrench
		ability to interpret manufacturers' specifications and instructions to reassemble accessories	
		ability to torque bolts	
		ability to match accessories with system design	
		ability to confirm operation of reassembled accessories	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

51.10	Performs leak test on system accessories.	knowledge of system and its components	tool pouch, halide torch kit, dye penetrant kit, electronic leak detector, air compressor and regulator, pressure gauge, nitrogen cylinder and regulator, pressure
		knowledge of system design and test pressures	

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of component pressure tolerances	temperature charts, micron gauge, vacuum pump
	knowledge of relief device locations and settings	
	ability to identify type of refrigerant	
	ability to select leak detection method and operate leak testing instruments	
	ability to visually identify indications of refrigerant leaks such as oil, damaged lines or components	
	ability to operate vacuum pumps and micron gauge to indicate a system leak	
	ability to employ inert gas to pressure up system	
	ability to inspect gaskets and seals	
	ability to perform refrigerant leak tests such as halide torch, soap solutions, dye penetrant system and electronic leak detector	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 52 **Installs system accessories.**

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
52.01	Removes packaging.	knowledge of techniques and procedures for handling accessories	tool pouch, crowbar, utility knife, electric saw

Sub-tasks		Enabling Objectives	Tools & Equipment
		knowledge of manufacturers' procedures to remove packaging ability to unload material/ equipment at assigned location ability to identify and report damages and/or shortages	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Sub-tasks		Enabling Objectives	Tools & Equipment
52.02	Verifies accessory specifications.	knowledge of types of accessories such as vibration eliminator, discharge muffler, crankcase heater, receiver, strainer and heat exchanger knowledge of operation of system accessories ability to interpret prints, diagrams and schematics of system accessories	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Sub-tasks		Enabling Objectives	Tools & Equipment
52.03	Mounts system accessories.	knowledge of types, sizes and capabilities of system accessories knowledge of hoisting and rigging techniques, procedures and devices knowledge of techniques and procedures to install and mount system accessories knowledge of equipment manufacturers' specifications knowledge of layout, location and space requirements of system	tool pouch, electric drill, hoisting equipment, rigging equipment

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of required clearances knowledge of installation codes knowledge of piping layout ability to position system accessories in accessible location for connections ability to communicate using standard approved hand signals for hoisting and rigging	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
52.04	Levels system accessories.	knowledge of levelling techniques and procedures knowledge of manufacturers' specifications, diagrams and instructions to level system accessories ability to select levelling devices ability to align, position and adjust system accessories ability to set up and operate levelling devices	bubble level, line level, precision level, hydraulic jacks

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
52.05	Connects piping/tubing.	knowledge of techniques and procedures to connect piping/tubing knowledge of threading, welding and brazing techniques and procedures	tube cutters, reamers, bending tools, flaring tools, torch kit, pipe threaders

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of affects of condition changes on operating system such as air/water flow, space, temperature, product load, humidity and superheat ability to connect pipe to refrigerant lines, drain and defrost lines according to piping layout and installation instructions ability to select and operate tools and test instruments ability to solder, braze and weld	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
52.06	Hooks up electrical power.	knowledge of power, voltage and phase requirements knowledge of basic electrical theory knowledge of conductors, insulators and horsepower knowledge of transformers knowledge of use of grounding equipment knowledge of lock out and tagging procedures for electrical equipment knowledge of federal, provincial/ territorial, municipal and general codes and standards affecting electrical hook ups of refrigeration and air conditioning systems knowledge of static electricity hazards	tool pouch, electric drill, ohmmeter, voltmeter, ammeter, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of components of electrical circuit ability to interpret wiring diagrams and schematics	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	NV

52.07	Adjusts system accessories.	knowledge of types, purpose and function of system accessories knowledge of system and application requirements for new refrigerant such as humidity, pressure and temperature knowledge of system operating parameters knowledge of location of system accessories ability to interpret manufacturers' specifications, diagrams and instructions for adjusting system accessories ability to interpret electrical diagrams, schematics and blueprints ability to select and operate test instruments such as temperature meter, voltage meter and pressure gauges ability to interpret pressure gauge, thermometer and meter readings ability to interpret pressure temperature charts	tool pouch, thermometer, temperature gauge, pressure gauge, psychrometer, tachometer, velometer, multimeter, ammeter, pressure temperature chart

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to test and confirm operation of system accessories	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

52.08	Performs leak test on system accessories.	knowledge of types of system accessories knowledge of system accessory design and test pressures knowledge of component pressure tolerances knowledge of relief device locations and settings ability to identify type of refrigerant ability to select leak detection method ability to visually identify indications of refrigerant leaks such as oil, damaged lines or components ability to select and operate leak detecting instruments ability to operate vacuum pumps and micron gauge to indicate a system leak ability to employ inert gas to pressure up system ability to inspect gaskets and seals ability to perform refrigerant leak tests such as halide torch, soap	tool pouch, halide torch kit, dye penetrant kit, electronic leak detector, air compressor and regulator, pressure gauge, nitrogen cylinder and regulator, vacuum pump, micron gauge

	Sub-tasks	Enabling Objectives	Tools & Equipment
		solutions, dye penetrant system and electronic leak detector	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

52.09	Certifies system accessories.	knowledge of certification requirements for system accessories knowledge of codes applicable to the re-certification of system accessories ability to arrange for inspections and testing by authorized personnel	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	NV

Task 53 **Diagnoses circulating pump malfunctions.**

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
53.01	Inspects circulating pump for mechanical wear.	knowledge of types and capabilities of circulating pumps ability to interpret manufacturers' specifications, diagrams and instructions for mechanical wear allowance ability to inspect coupler, seals and motor for excessive wear	tool pouch, alignment tools, micron gauge, calipers

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to measure coupler, seals and motor wear	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
53.02	Checks functionality and output of electrical components.	knowledge of types and capabilities of electrical components ability to interpret manufacturers' specifications, diagrams and instructions ability to interpret electrical wiring diagrams and schematics ability to visually inspect operation of controls and components ability to select and operate test instruments	tool pouch, ammeter, multimeter, precision gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
53.03	Checks operating pressures.	knowledge of existing system and its intended application knowledge of design pressures and flow rates ability to set up, calibrate and operate test instruments and pressure gauges ability to measure inlet and outlet pressure of circulating pump	tool pouch, pressure gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
53.04	Checks capacity control system.	knowledge of existing system and its intended application knowledge of types of capacity controls knowledge of set up and operation of capacity controls knowledge of control system used to operate capacity control knowledge of variable speed pumps such as fluid coupling, silicon-controlled rectifier (SCR), variable frequency, direct current, wound rotor, eddy current drives ability to interpret manufacturers' specifications, diagrams and instructions regarding capacity control set up and check out ability to sequence multiple pumps in parallel and series ability to check capacity control by varying system loads	tool pouch, multimeter, ammeter, pressure gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

53.05	Verifies fluid flow.	knowledge of existing system and its intended application ability to check pressure difference across circulating pump to confirm flow ability to set up, calibrate and operate fluid flow instruments	flow meter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
53.06	Performs leak test.	knowledge of types of circulating pumps such as positive displacement including reciprocating, gear vane, screw and rotary, centrifugal including in-line close coupled, simple suction inlet, double suction inlet and liquid overfeed refrigerant knowledge of components of circulating pumps such as impellers, motors, relays, and seals including packing and mechanical, speed controllers, inlet screen and gaskets knowledge of circulating pump design and test pressure knowledge of allowable tolerances knowledge of relief device locations and settings ability to visually identify indication leaks ability to inspect gaskets and seals ability to perform refrigerant leak test for liquid overfeed pump systems	tool pouch, halide torch kit, dye penetrant system, electronic leak detector, pressure gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

53.07	Checks alignment.	knowledge of techniques and procedures for checking alignment knowledge of manufacturers' specifications for tolerances ability to interpret manufacturers' specifications, diagrams and instruction for aligning pump	tool pouch, alignment tools

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to perform alignment adjustments	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
53.08	Determines cause of failure.	knowledge of test procedures in order to determine cause of failure	tool pouch, multimeter, ammeter, pressure gauge
		knowledge of circulating pumps and starting mechanisms	
		ability to interpret manufacturers' specifications, diagrams and instructions to diagnose cause of failure	
		ability to visually, audibly and physically inspect components and power supply	
		ability to select and operate test instruments	
		ability to interpret electrical wiring diagrams and schematics	
		ability to isolate cause of failure to specific components	
		ability to identify probable reason for component failure	
		ability to set up, calibrate and operate test instruments	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
53.09	Determines repair requirements.	knowledge of techniques and procedures for repairing circulating pumps	tool pouch, multimeter, ammeter, pressure gauge

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of size, quantity, voltage, phase and capacity of circulating pumps	
	knowledge of circulating pump components such as impellers, motors, relays, and seals including packing and mechanical, speed controllers, inlet screen and gaskets	
	ability to interpret manufacturers' specifications, diagrams and instructions for repairing circulating pumps	
	ability to identify, select and obtain replacement parts and components	
	ability to determine length of time required for repair	
	ability to document information on failed components such as manufacturers' model and serial number	
	ability to determine component repair, replacement feasibility and system replacement	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

53.10	Determines warranty status.	knowledge of periods of warranty for parts, components and systems	tool pouch
		ability to locate and identify parts, components and system model and serial numbers	
		ability to determine pump manufacturer and installation dates	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to complete warranty cards and forms	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

Task 54 Overhauls circulating pumps.

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
54.01	Shuts down system, including lock out.	knowledge of techniques, procedures and sequence to shut down and lock out circulating pumps knowledge of system and its layout knowledge of site specific lock out requirements knowledge of code requirements and operating specifications for utilities ability to interpret manufacturers' specifications for shutting down and locking out circulating pumps ability to identify location of primary and secondary utility isolation devices such as valves, breakers and disconnects ability to mechanically lock out isolation device(s) and to label devices to prevent accidental tampering	tool pouch, padlock, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to confirm system shutdown and lock out	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
54.02	Isolates circulating pump.	knowledge of manufacturers' techniques and procedures to isolate circulating pump knowledge of operation of circulating pumps knowledge of power, voltage and phase requirements knowledge of circulating pump components such as impellers, motors, relays, and seals including packing and mechanical, speed controllers, inlet screen and gaskets knowledge of types, location and functions of valves knowledge of electrical and installation codes ability to isolate circulating pump using valves relating to refrigerant, water, glycol and brine ability to select, calibrate and operate tools and test equipment	tool pouch, pressure gauge, multimeter, voltmeter, ammeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
54.03	Recovers refrigerant.	knowledge of types of refrigerants such as HFC, CFC, HCFC and ammonia and their composition	tool pouch, recovery/ recycle unit, manifold pressure gauge, oil pump, weigh scale

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of techniques and procedures to recover/recycle refrigerant knowledge of types and sizes of recovery equipment such as recovery/recycle unit knowledge of CFC regulations knowledge of valve position within system knowledge of test instruments ability to determine type and quantity of refrigerant to be removed ability to interpret refrigerant management instructions and refrigerant recovery codes and regulations ability to change oil and filter driers in recovery unit ability to operate weigh scales ability to set up and operate recovery equipment including recovery tank float level switches ability to monitor system pressures	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
54.04	Drains fluids.	knowledge of techniques and procedures for draining fluids knowledge of types of fluids knowledge of safety procedures when handling fluids	tool pouch, funnel, hoses, recovery/recycle unit

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of location and method for disposing and recycling fluids knowledge of recycling requirements and equipment for fluids ability to visually inspect fluids for contamination ability to retrieve and store fluids ability to dispose of fluid	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
54.05	Disassembles circulating pump.	knowledge of techniques, procedures and sequences to disassemble circulating pumps knowledge of manufacturers' specifications and diagrams knowledge of pipe connections and fittings ability to identify defective components such as impellers, rotors, relays and seals ability to operate rigging and hoisting equipment ability to mark components for reassembly sequence ability to select and operate test equipment	tool pouch, rigging equipment, hoisting equipment, come-along, slings

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
54.06	Inspects circulating pump components.	knowledge of circulating pump assembly types such as positive displacement including reciprocating, gear vane, screw and rotary, centrifugal including in-line close coupled, simple suction inlet, double suction inlet and liquid overfeed refrigerant. knowledge of packing conditions ability to recognize damaged, worn, misaligned, corroded, burnt, incorrect and loose components	tool pouch, micrometer, alignment tools

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
54.07	Selects replacement components.	knowledge of size and type of component, capacity, voltage, phase and quantity ability to interpret manufacturers' specifications, diagrams and instructions to assist in the identification of parts and components ability to identify information on failed part(s) such as manufacturer, model and serial number ability to determine if component repair is feasible as compared to component replacement ability to match component or part to type of system	tool pouch, multimeter, ammeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
54.08	Repairs defective components.	knowledge of techniques and procedures to repair defective components knowledge of function of circulating pumps knowledge of system and its layout knowledge of safety requirements such as lock out or power down of control panel ability to interpret manufacturers' specifications, diagrams and instructions for repairing components ability to select and operate testing equipment such as multimeter and ammeter ability to power down panel and lock out breakers	tool pouch, ammeter, multimeter, alignment tools, power drill

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

54.09	Replaces defective components.	knowledge of techniques and procedures to remove and replace defective components knowledge of types, sizes and capacities of circulating pump components knowledge of fastening and mounting hardware ability to interpret manufacturers' specifications, diagrams and instructions for replacing components ability to rig and hoist components	tool pouch, multimeter, ammeter, alignment tools, rigging equipment, hoisting equipment

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to select and operate specialty tools and testing equipment such as multimeter and ammeter ability to sequence the removal and replacement of components ability to match replacement components to meet system requirements ability to adjust component for designed operation ability to functionally test components and systems to verify operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

54.10	Reassembles circulating pump.	knowledge of techniques and procedures for assembling circulating pumps knowledge of types of circulating pumps and components knowledge of original system specifications knowledge of operational parameters for circulating pump systems knowledge of fastening and mounting hardware ability to interpret manufacturers' specifications, diagrams and instructions ability to rig and hoist components	tool pouch, multimeter, ammeter, alignment tools, rigging equipment, hoisting equipment

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to sequence the replacement of components ability to select and operate testing equipment such as multimeter and ammeter ability to functionally test circulating pump to verify operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

Sub-tasks	Enabling Objectives	Tools & Equipment
54.11 Performs leak test on system.	knowledge of techniques and procedures to perform leak test on system knowledge of circulating pump system and its components knowledge of circulating pump system test pressures knowledge of component pressure tolerances knowledge of relief device locations and settings ability to identify type of refrigerant ability to select leak detection method and operate leak detecting instruments ability to visually identify indications of leaks ability to operate vacuum pumps and micron gauge to indicate a system leak ability to employ inert gas to pressure up system	tool pouch, halide torch kit, dye penetrant kit, electronic leak detector, air compressor and regulator, vacuum pump, micron gauge, pressure gauge, nitrogen cylinder and regulator

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to inspect gaskets and seals	
		ability to perform refrigerant leak tests such as halide torch, soap solutions, dye penetrant system and electronic leak detector	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

Task 55 Installs circulating pumps.

Trend: Towards the use of more versatile pumps.

	Sub-tasks	Enabling Objectives	Tools & Equipment
55.01	Removes shipping materials.	knowledge of techniques and procedures for removing shipping material	tool pouch, crow bar, electric saw
		ability to interpret manufacturers' specifications, diagrams and instructions regarding the location and removal of shipping materials	
		ability to unload material or equipment at assigned location	
		ability to identify and report damages and/or shortages	
		ability to dispose of waste material	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
55.02	Verifies circulating pump specifications.	knowledge of pump specifications such as size, capacity, model number, serial number, voltage, phase, certification standards and codes knowledge of open and sealed pump assemblies knowledge of direct drive or belt driven pump assemblies including electric motor, combustion engine and steam turbine drives knowledge of circulating pump components such as pump assemble, drive mechanism assembly, valves, seal, couplings and wiring controls knowledge of hoisting and rigging techniques and procedures ability to interpret manufacturers' specifications, and shop drawings ability to confirm specifications meet design and installation procedures	hoisting equipment, rigging equipment

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

55.03	Mounts circulating pump.	knowledge of techniques and procedures for mounting circulating pumps knowledge of circulating pump assembly space requirements knowledge of type and sizes of pumps knowledge of drive mechanism knowledge of piping layout	tool pouch, hoisting equipment, rigging equipment, electric drills, electric hammer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of installation codes	
		knowledge of operation of centrifugal pumps such as pump construction, pump location in system, effect of incorrect pump rotation and cause of cavitation in pump assembly	
		knowledge of effect of pressure losses on pump	
		knowledge of safe rigging and handling of circulating pump in order to prevent damage	
		ability to interpret manufacturers' specifications, diagrams and instructions for positioning and mounting such as direction of flow, vibration and valve location	
		ability to position compressor in accessible location for connections	
		ability to select, operate and calibrate tools and equipment	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

55.04	Mounts controls or valves.	knowledge of techniques and procedures for mounting controls and valves	tool pouch, drill, pipe threader, flaring tools, tube cutters, arc welder, torch kit
		knowledge of required positioning and mounting of controls and valves for operation and service	
		knowledge of types, sizes and capacities of controls and valves	
		ability to identify and select controls and valves according to manufacturers' specifications,	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		application diagrams, plans and shop drawings ability to interpret blueprints and shop drawings ability to operate oxy-acetylene, turbo and propane torch kit ability to braze, solder, weld	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
55.05	Aligns circulating pump.	knowledge of techniques and procedures to align circulating pumps knowledge of manufacturers' specifications, diagrams and instructions to align pump and driving device ability to position device for piping, electrical service, control service, motor alignment, coupling, and pulley and belt alignment ability to adjust controls	tool pouch, alignment tools

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
55.06	Levels circulating pump.	knowledge of techniques and procedures for levelling circulating pumps knowledge of manufacturers' specifications, diagrams and instructions to level circulating pump	tool pouch, bubble level, line level, precision level, pressure gauge, flow meter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to set up and operate levelling devices	
		ability to balance pump assembly	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

55.07	Hooks up electric motor or power supply.	knowledge of power, voltage and phase requirements	tool pouch, electric drill, multimeter, ammeter, phase meter
		knowledge of basic electrical theory	
		knowledge of conductors, insulators and horsepower	
		knowledge of transformers	
		knowledge of use of grounding equipment	
		knowledge of lock out and tagging procedures for electrical equipment	
		knowledge of federal, provincial/territorial, municipal and general codes and standards affecting electrical hook ups of refrigeration and air conditioning systems	
		knowledge of static electricity hazards	
		knowledge of components of electrical circuit	
		ability to test for voltage, phase, overload protection and rotation	
		ability to interpret wiring diagrams and schematics	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to verify hook up of electric motor or power supply to the circulating pump	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
55.08	Connects refrigerant/ solution piping/tubing.	knowledge of techniques and procedures to connect piping/tubing to circulating pump knowledge of required connections from pump to piping/tubing ability to apply gasket, O-rings and sealants ability to select, calibrate and operate tools and test instruments ability to apply torque to fasten bolts ability to set up and operate connecting equipment such as threaders, flaring tools, welder and torches	tool pouch, tube cutters, tube reamers, pressure gauge, flaring tools, bending tools, pipe threaders, oxy-acetylene torch kit, nitrogen cylinder and regulator, welding kit, torque wrench

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
55.09	Checks piping/tubing connections, including couplings and fittings.	knowledge of techniques and procedures to check piping/tubing connections knowledge of location of piping/ tubing connections knowledge of piping diagrams including codes and symbols	tool pouch

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret blueprints, diagrams, schematics and specifications ability to visually and physically check piping/tubing connections, couplings and fittings to confirm connections, alignment and sealing ability to determine replacement needs ability to adjust connections including couplings and fittings ability to recognize abnormal pump operation due to undersized or oversized piping, oil return problems and loss of sub-cooling	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

55.10	Evacuates non-condensibles from system.	knowledge of required vacuum readings and durations ability to interpret vacuum gauges to ensure evacuation and absence of any leaks and moisture ability to operate vacuum pump ability to replace vacuum pump oil ability to set up and operate pressure gauges, micron gauges and vacuum pumps	tool pouch, vacuum pump, vacuum gauge, compound gauge, micron gauge, manometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
55.11	Performs leak test on pumps.	knowledge of techniques and procedures to perform leak test knowledge of circulating pump system and its components knowledge of circulating system design and test pressures knowledge of component pressure tolerances knowledge of relief device locations and settings ability to identify type of refrigerant ability to select leak detection method and operate leak detector ability to visually identify indications of leaks ability to operate vacuum pumps and micron gauge to indicate a system leak ability to employ inert gas to pressure up system ability to inspect gaskets and seals ability to perform refrigerant leak tests such as halide torch, soap solutions, dye penetrant system and electronic leak detector	tool pouch, halide torch kit, dye penetrant kit, electronic leak detector, air compressor and regulator, pressure gauge, nitrogen cylinder and regulator, vacuum pump, micron gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	NV

Task 56 **Performs preventive maintenance on refrigeration and air conditioning systems.**

Trend: Towards the development of scheduled maintenance programs to increase system efficiency, extend equipment life and reduce emergency repairs.

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.01	Checks operating temperatures and humidity.	knowledge of system humidity and temperature requirements knowledge of system and its intended application knowledge of allowable temperature and humidity tolerances ability to select, calibrate and operate test instruments	tool pouch, pressure gauge, thermometer, psychrometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.02	Cleans coils and fans.	knowledge of techniques and procedures to clean coils and fans knowledge of operation of coils and fans ability to visually inspect coils and fans ability to select cleaning method and materials ability to clean coils using brushes, chemicals and power washers ability to clean coils using air, nitrogen and carbon dioxide pressurized gases	tool pouch, fin combs, steel brushes, carbon dioxide cylinder and regulator, nitrogen cylinder and regulator, air tank and regulator, power washers, hand sprayers, hose, personal protective equipment

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.03	Tests functionality of operating and safety controls.	knowledge of techniques and procedures to test functionality of operating and safety controls ability to interpret manufacturers' specifications, diagrams and instructions ability to interpret electrical wiring diagrams and schematics ability to visually inspect operation of controls and components to assure operation ability to inspect operation of controls using test instruments	tool pouch, multimeter, ammeter, pressure gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.04	Checks system operating pressures.	knowledge of system, its intended application and design pressures knowledge of allowable tolerances for design pressures knowledge of types of refrigerants such as ammonia, HFC, CFC and HCFC knowledge of pressure temperature charts ability to select, calibrate and operate test instruments and pressure gauges	tool pouch, pressure gauge, thermometer, pressure temperature charts

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.05	Obtains oil samples for analysis.	knowledge of system and its intended application knowledge of approved testing facilities for independent sample testing ability to pump down and isolate compressor or vessel when oil sample is to be taken ability to operate oil pump ability to interpret results of acid test kits	tool pouch, oil pump, pressure gauge, acid test kit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

56.06	Obtains refrigerant samples for analysis.	knowledge of system and its intended application knowledge of approved testing facilities for independent sample testing ability to position valves to obtain refrigerant sample ability to interpret results of refrigerant test kits	tool pouch, pressure gauge, sample container

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

56.07	Tightens loose electrical connection(s).	knowledge of techniques and procedures to tighten loose electrical connections knowledge of electrical connection tolerances	tool pouch, multimeter, ammeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to physically and visually inspect electrical connections for tightness ability to tighten electrical connectors to secure wiring ability to select, calibrate and operate test instruments	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.08	Analyzes chiller solutions for contaminants.	knowledge of system and its intended application knowledge of types of chiller solutions knowledge of testing procedures to determine pH level knowledge of system problems that exist under alkaline and acidic solution knowledge of system inhibitors knowledge of required frequency of sample testing ability to obtain sample of chiller solution	tool pouch, pH testing kit, goggles, gloves

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.09	Conducts vibration analysis.	knowledge of system and its intended application knowledge of manufacturers' specifications, diagrams and	tool pouch, sound level meters, vibration analysis equipment, strobe lights, stethoscope

	Sub-tasks	Enabling Objectives	Tools & Equipment
		instructions to identify the tolerances for vibration and isolation installation procedures	
		ability to confirm system balance matches balance specifications including flows, speeds (rpm), capacity, and velocity	
		ability to visually and physically check equipment for identification of curve or vibration	
		ability to ensure free floating isolating systems	
		ability to perform audible check of equipment	
		ability to inspect bearings using a stethoscope	
		ability to select, calibrate and operate vibration test instruments such as sound level meter, vibration meter, vibration analyzer, strobe lights and stethoscope	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	no	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.10	Measures voltage and current for major components.	knowledge of component rated voltage and current	tool pouch, multimeter, ammeter
		knowledge of component allowable tolerances for voltage and current	
		knowledge of allowable voltage and current unbalance	
		ability to select, calibrate and operate test instruments	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to calculate voltage and current unbalance	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.11	Conducts thermography test for hot spots.	knowledge of infrared thermography test equipment ability to interpret manufacturers' specifications, diagrams and instructions to operate infrared thermography equipment ability to operate infrared thermography equipment **(NOT COMMON CORE)**	tool pouch, infrared thermography camera, infrared thermography display unit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	no	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.12	Inspects bearings.	knowledge of types of bearings such as ball, bushings and roller knowledge of types of bearing lubricators knowledge of allowable clearances and tolerances for bearings ability to remove bearings	tool pouch, micron gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.13	Checks compressor oil levels.	knowledge of techniques and procedures to check oil levels	tool pouch

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of oil levels and tolerances for the compressor	
		ability to interpret manufacturers' specifications for checking compressor oil levels	
		ability to visually inspect oil levels	
		ability to interpret indicating devices such as sight glasses and dip sticks	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.14	Checks refrigerant levels.	knowledge of techniques and procedures to check refrigerant levels	tool pouch
		knowledge of system design and intended application	
		ability to interpret manufacturers' specifications for refrigerant levels	
		ability to visually inspect sight glasses and liquid level indicator to determine refrigerant level	
		ability to determine the reason for fluctuation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.15	Conducts functional operation of fans.	knowledge of system design and intended application	tool pouch, multimeter, ammeter
		knowledge of types of fans and fan drive motors	

ability to interpret manufacturers' specifications, diagrams and instructions

ability to determine fan rotation

ability to interpret electrical wiring diagrams and schematics

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.16	Completes inspection report.	knowledge of information required for inspection reports ability to document date and time of inspection ability to document model number, serial number and manufacturer ability to document work completed	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.17	Maintains equipment log book.	knowledge of information required for log book ability to document information regarding system alarms, repairs, modifications and complaints in order to establish equipment history ability to document date, time and location of repair	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.18	Inspects condenser and evaporators for fouling.	knowledge of operation of condensers and evaporators knowledge of condenser and evaporator malfunctions ability to interpret eddy current test data report ability to visually check condensers and evaporator coils for debris build up ability to clean evaporators and condensers	tool pouch, power washer, brush and tube cleaning equipment

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.19	Inspects operation of in-let vanes for air conditioning systems.	knowledge of operation of inlet vanes knowledge of system and its intended application knowledge of set up and operation of inlet vanes knowledge of types of actuators in order to control inlet vanes such as electronic, hydraulic, pneumatic and electric ability to visually inspect in-let vanes for damage	tool pouch, pneumatic calibration kit, multimeter, ammeter, pressure gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.20	Identifies system leaks.	knowledge of leak testing methods and equipment	tool pouch, pressure gauge, halide torch kit, electronic leak detector, litmus paper, sulphur

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of system, application and physical layout	stick, dye penetrant ultrasonic leak detector
		knowledge of types of system refrigerant	
		ability to select leak test method	
		ability to select and operate leak detection instruments	
		ability to visually identify refrigerant leak or physical damage	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

56.21	Identifies blockages in drain lines.	knowledge of system and application	tool pouch
		knowledge of location of drain lines	
		ability to visually inspect condensate pans and drain lines to identify the source of blockage	
		knowledge of installation procedures for drain lines	
		ability to inspect drain lines for size, slope, and "P" traps	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

56.22	Runs on-board diagnostics.	knowledge of diagnostic techniques, procedures and testing devices	tool pouch, multimeter, ammeter, thermometer, computer terminal, printer
		knowledge of types of refrigeration and air conditioning systems and their functions	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of troubleshooting methods for refrigeration and air conditioning systems	
		knowledge of operation of on-board diagnostic control devices such as touch pad and control panel	
		ability to interpret original equipment and manufacturers' literature	
		ability to identify and interpret fault codes	
		ability to interpret electrical wiring diagrams and schematics	
		ability to visually and physically check system and components to confirm fault code origination	
		ability to operate specialized troubleshooting instruments such as computer, key pads and printer	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.23	Conducts eddy current analysis.	knowledge of manufacturers' techniques and procedures to conduct eddy current analysis	tool pouch, eddy current instrument
		knowledge of in-service history of system	
		knowledge of material composition	
		ability to set up, calibrate and operate eddy current equipment	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to scan component **(NOT COMMON CORE)**	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	no	no	no	no	yes	yes	no	NV

56.24	Lubricates motors and drives.	knowledge of techniques and procedures to lubricate motors and drives knowledge of system and its application knowledge of location of components knowledge of types and uses of lubricants ability to interpret manufacturers' specifications, diagrams and instructions for lubricating requirements ability to select lubricants ability to identify the quantity and frequency schedule for lubricating	tool pouch, grease gun

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

56.25	Inspects belts.	knowledge of types and sizes of belts ability to measure belts ability to visually inspect belts for wear, tension and alignment ability to select replacement belts	tool pouch, straight edge, alignment tools

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to align and tighten belts	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.26	Checks coupling alignment.	knowledge of techniques and procedures for alignment ability to interpret manufacturers' specifications, diagrams and instructions for coupling alignment ability to measure alignment	tool pouch, alignment tools

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
56.27	Completes inspection report.	knowledge of information required for inspection report ability to document information on system such as model and serial number, refrigerant, voltage, current, oil level, pressures and temperatures ability to document date and time of inspection ability to document required repairs or recommended modifications ability to provide information for estimate preparation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 57 **Performs preventative maintenance on heating, air conditioning and heat pump systems.**

Trend: Towards scheduled maintenance programs to increase system efficiency and air quality, extend equipment life and reduce emergency repairs.

	Sub-tasks	Enabling Objectives	Tools & Equipment
57.01	Checks drain line crankcase and mullion heaters for refrigeration systems.	knowledge of manufacturers' techniques and procedures for checking drain line crankcase and mullion heaters knowledge of purpose and location of heater ability to visually and physically inspect power and control wiring, wiring connections and contacts ability to check calibration of operating and safety controls ability to interpret electrical wiring diagrams and schematics ability to select, calibrate and operate test instruments to check heater operation	tool pouch, multimeter, ammeter, pressure gauge, thermometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
57.02	Checks burner set up and operation for heating systems.	knowledge of system and its intended application knowledge of burner efficiency knowledge of testing procedures for burners knowledge of manufacturers' lubrication recommendations for bearings	tool pouch, thermometer, smoke tester, filter paper, draft gauge, CO_2 analyzer, oxygen tester, electronic flue gas tester

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of induced draft blowers and their function	
	ability to interpret manufacturers' specifications, diagrams and instructions	
	ability to calibrate induced draft blower's air flow	
	ability to lubricate bearings	
	ability to inspect bearings for wear	
	ability to visually and physically inspect power and control wiring, wiring connections and contacts	
	ability to check calibration of operating and safety controls	
	ability to perform combustion efficiency analysis for oil and propane and natural gas combustion equipment	
	ability to perform draft readings, smoke spot test, stack temperature measurements, carbon dioxide measurements, oxygen measurements and ambient temperature measurements	
	ability to calculate system efficiency	
	ability to interpret test results	
	ability to adjust burner and controls to improve efficiency	
	ability to operate standard and electronic flue gas analysis kits	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
57.03	Inspects venting system for heating systems.	knowledge of techniques and procedures for inspecting venting systems knowledge of air flow distribution knowledge of manufacturers' lubrication recommendations for bearings knowledge of induced draft blowers and their function ability to interpret manufacturers' specifications, diagrams and instructions for venting systems ability to calibrate induced draft blowers air flow ability to lubricate bearings ability to inspect bearings for wear ability to visually and physically inspect power and control wiring, wiring connections and contacts ability to check calibration of operating and safety controls ability to ensure air flow	tool pouch, pressure gauge, velometer, thermometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

57.04	Performs combustion check for heating systems.	knowledge of system and its intended application knowledge of heating efficiency knowledge of testing procedures	tool pouch, thermometer, smoke tester, filter paper, draft gauge, CO_2 analyzer, oxygen tester, electronic flue gas tester

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of induced draft blowers and their function	
		ability to interpret manufacturers' specifications, diagrams and instructions	
		ability to calibrate induced draft blower's air flow	
		ability to perform combustion efficiency analysis for oil, propane and natural gas combustion equipment	
		ability to perform draft readings, smoke spot test, stack temperature measurements, carbon dioxide measurements, oxygen measurements and ambient temperature measurements	
		ability to calculate system efficiency	
		ability to interpret test results	
		ability to adjust burner and controls to improve efficiency	
		ability to operate standard and electronic flue gas analysis kits	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

57.05	Inspects air supply for heating systems.	knowledge of system and its intended application	tool pouch, pressure gauge, velometer, thermometer
		knowledge of air flow requirements	
		knowledge of bearing manufacturers' lubrication recommendations	
		ability to lubricate bearings	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to inspect bearings for wear ability to visually inspect system for blockage such as dirty filter and collapsed insulation ability to operate air flow measuring equipment	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
57.06	Checks for cracked heat exchangers for heating systems.	knowledge of techniques and procedures for checking heat exchangers for heating systems ability to visually check heat exchangers for cracks, corrosion and physical damage ability to locate leaks using smoke bombs	tool pouch, smoke bombs, flashlight, mirror

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
57.07	Checks operation and condition of heating sections.	knowledge of system and its intended application knowledge of system operation and its layout knowledge of induced draft blowers and their function ability to interpret manufacturers' specifications, diagrams and instructions for checking the operation and system condition ability to calibrate induced draft blowers air flow	tool pouch, multimeter, ammeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to visually, physically and audibly check system operation	
		ability to visually check system for physical damage and corrosion	
		ability to interpret wiring diagrams and schematics	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
57.08	Checks electronic (electrostatic) air cleaner for air conditioning and heat pump systems.	knowledge of operation of electrostatic air cleaners	tool pouch, multimeter, ammeter
		ability to interpret manufacturers' specifications, diagrams and instructions for the operation and maintenance of electronic air cleaners	
		ability to visually and physically inspect power and control wiring, wiring connections and contacts	
		ability to check calibration of operating and safety controls	
		ability to visually inspect grid for fouling	
		ability to interpret electrical wiring diagrams and schematics	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
57.09	Changes filters for air conditioning and heat pumps.	knowledge of techniques and procedures to change filters	tool pouch, pressure gauge
		knowledge of types of filters and their applications	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of system and application knowledge of type and rating of filters knowledge of replacement or cleaning frequency of filters ability to interpret manufacturers' specifications, diagrams and instructions ability to visually inspect filter fouling ability to operate extended indicators to determine filter resistance ability to remove and replace filter or filter media ability to replace filter rolls in automatic filtration units	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

57.10	Checks crankcase heaters for air conditioning and heat pumps.	knowledge of purpose and location of heaters knowledge of temperature parameters and specifications ability to interpret manufacturers' specifications, diagrams and instructions ability to visually and physically inspect power and control wiring, wiring connections and contacts ability to check calibration of operating and safety controls	tool pouch, multimeter, ammeter, thermometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret electrical wiring diagrams and schematics ability to set up, calibrate and operate test equipment	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

57.11	Checks operation of economizer for air conditioning and heat pumps.	knowledge of techniques and procedures to check operation of economizer knowledge of system and its intended application knowledge of minimum ventilation requirements and mixed air temperature knowledge of economizer system components, their set up and sequence of operation knowledge of economizer control settings knowledge of check out procedures for economizer controls ability to interpret manufacturers' specifications, diagrams and instructions ability to inspect and lubricate damper linkages and control arms ability to lubricate damper linkages and control arms ability to visually and physically inspect power and control wiring, wiring connections and contacts	tool pouch, pressure gauge, multimeter, velometer, calculator, thermometer, psychrometer, ammeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to check calibration of operating and safety controls ability to select, calibrate and operate test instruments to measure air flow ability to set up and inspect economizer	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

57.12	Checks operation of humidification systems, air conditioning and heat pumps.	knowledge of types of humidifiers such as pan type, webbed element, webbed drum, bypass webbed element, atomizing, heated pan, enclosed steam grid, self contained steam, bucketed steam and pneumatic atomizing humidifier knowledge of humidity control devices knowledge of humidifier operation knowledge of system and its application ability to interpret manufacturers' specifications, diagrams and instructions ability to visually and physically inspect power and control wiring, wiring connections and contacts ability to check calibration of operating and safety controls ability to determine humidity levels ability to interpret electrical wiring diagrams and schematics	tool pouch, multimeter, ammeter, pressure gauge, psychrometer, thermometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to visually check condition of humidifier for fouling, scaling, corrosion or physical damage	
		ability to set up, maintain and repair equipment	
		ability to interpret on-board diagnostics	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

57.13	Checks operation of dehumidification systems for air conditioning and heat pumps.	knowledge of system and its intended application	tool pouch, psychrometer, thermometer, multimeter, ammeter
		knowledge of dehumidifier components such as coils, compressors, fans, condensate lines and pans	
		knowledge of humidity levels and tolerances	
		ability to interpret manufacturers' specifications, diagrams and instructions	
		ability to visually and physically inspect power and control wiring, wiring connections and contacts	
		ability to check dehumidifier for discharge of condensate	
		ability to visually inspect coils for frost build-up	
		ability to check calibration of operating and safety controls	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to set up, calibrate and operate test instruments	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
57.14	Checks refrigeration and heat pump defrost controls.	knowledge of types of defrost controls ability to interpret manufacturers' specifications, diagrams and instructions to check defrost cycle operation ability to visually and physically inspect power and control wiring, wiring connections and contacts ability to check calibration of operating and safety controls ability to interpret electrical wiring diagrams and schematics ability to interpret on-board diagnostics ability to visually and physically check sequential operation of defrost ability to check frequency of defrost	tool pouch, pressure gauge, thermometer, ammeter, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
57.15	Checks supplementary heat for heat pumps.	knowledge of techniques, procedures and sequence to check supplementary heat knowledge of system and its intended application	tool pouch, pressure gauge, thermometer, ammeter, multimeter

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to interpret manufacturers' specifications, diagrams and instructions	
	ability to visually and physically inspect power and control wiring, wiring connections and contacts	
	ability to check calibration of operating and safety controls	
	ability to check operation of supplementary heat	
	ability to interpret electrical wiring diagrams and schematics	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

BLOCK F CONTROL SYSTEMS

Task 58 Diagnoses metering device malfunctions.

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
58.01	Inspects metering devices visually.	knowledge of types of metering devices such as capillary tube, automatic expansion valve, thermostatic expansion valve, hand operated expansion valve, high/low pressure float valve, pitot operated	tool pouch, thermometer, goggles, rubber gloves

Sub-tasks	Enabling Objectives	Tools & Equipment
	thermostatic expansion valve and orifice devices knowledge of fundamentals of operation and design of metering devices knowledge of manufacturers' specifications, charts, tables and schematics knowledge of electric, electronic and pneumatic controls ability to visually check system and components for corrosion, fouling and damage ability to check for defective parts, line restrictions and loose fittings ability to check valve operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

58.02	Runs on-board diagnostics.	knowledge of diagnostic techniques, procedures and testing devices knowledge of types of metering devices and their functions knowledge of trouble-shooting methods for metering devices knowledge of operation of on-board diagnostic control devices such as touch pad and control panel ability to interpret original equipment and manufacturers' literature	computer terminal, printer, multimeter, manifold pressure gauge

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret information such as software and input status, wiring continuity and system failure ability to identify and interpret fault codes ability to interpret electrical wiring diagrams and schematics ability to visually and physically check system and components to confirm fault code origination ability to operate specialized troubleshooting instruments such as computer terminal and printer	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
58.03	Checks functionality and output of electrical components.	knowledge of operating procedures for electrical/electronic components knowledge of metering devices and metering device components such as strainers, valves, bellows and distributors ability to interpret electrical schematics, charts, fault trees and manufacturers' recommended service manuals ability to identify electrical symbols ability to simulate changing temperatures and pressures and monitor control action ability to check for loose, worn or frayed electrical connections	tool pouch, multimeter, voltmeter, ammeter, simulators

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to check electric motors and test electrical components ability to check and calibrate electric, electronic and pneumatic controls ability to interpret test results	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
58.04	Checks operating temperatures, and superheat pressures.	knowledge of system design temperatures and superheat pressures knowledge of allowable tolerances for design temperature and superheat pressures knowledge of valve types such as automatic expansion, thermostatic expansion, hand operated expansion, low and high pressure float ability to locate faults such as temperature and pressure fluctuations ability to identify overheating problems ability to adjust valves to meet operating requirements ability to set up, calibrate and operate test instruments ability to interpret test results	tool pouch, electronic temperature sensor, multimeter, ammeter, pressure gauge, pressure regulator, thermometer, psychrometer, pressure temperature chart

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
58.05	Performs leak test.	knowledge of leak test methods and safety precautions	manifold pressure gauge, halide torch kit,

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types of refrigerants	pressure regulator, soap solution
		knowledge of manufacturers' specifications and guidelines	
		ability to select and operate leak detecting equipment	
		ability to inspect gaskets and seals	
		ability to interpret test results	
		ability to determine source of leaks	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

58.06	Determines cause of failure.	knowledge of types of metering devices and components	tool pouch, multimeter, ammeter, manifold pressure gauge, combustion analyzer, thermometer, psychrometer
		knowledge of manufacturers' specifications and operating procedures	
		knowledge of types of potential malfunctions in metering devices	
		ability to interpret charts, schematics, tables, electrical wiring diagrams and diagnostic test procedures	
		ability to recognize effects of malfunctions such as inoperable valves, differences in air/water flow, line restrictions, incorrect component sizes, excess superheat and low suction pressure	
		ability to observe load variations, loose connections and fittings	
		ability to operate testing and measuring equipment	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to test electrical components	
		ability to isolate problem to specific area/component	
		ability to analyze findings	
		ability to report cause of failure	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

58.07	Determines repair requirements.	knowledge of types of metering devices	
		knowledge of manufacturers' specifications	
		knowledge of work to be performed, length of repair and time required	
		knowledge of area to be repaired such as electrical, temperature and pressure controls	
		knowledge of cost of system components and part availability	
		knowledge of warranty coverage	
		ability to determine if components should be repaired or replaced	
		ability to interpret diagnostic test procedures	
		ability to isolate problem to specific area	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to prepare an estimate including list of parts, cost of repair and time required for repair	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 59 Overhauls metering devices.

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
59.01	Shuts down system, including lock out.	knowledge of types of metering devices such as capillary tube, automatic expansion valve, thermostatic expansion valve, hand operated expansion valve and low/ high pressure float valve knowledge of sequence of shut down procedures knowledge of electricity and electrical codes knowledge of test instruments ability to interpret manufacturers' specifications, charts, tables and schematics ability to ensure electrical and energy sources are isolated ability to pump down system	tool pouch, padlock, multimeter, manifold pressure gauge

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to disengage system in order to repair system or component	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

59.02	Isolates metering devices.	knowledge of techniques and procedures to isolate metering devices knowledge of metering device components knowledge of fundamentals of operation and design of metering devices knowledge of shut down and start up procedures knowledge of electrical components and test instruments ability to interpret charts, tables and schematics ability to valve off part of system to repair system and/or component ability to adjust or loosen off adjoining parts	tool pouch, pressure gauge, multimeter, ammeter, padlock

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

59.03	Recovers refrigerant.	knowledge of types of refrigerants and their composition knowledge of techniques and procedures to recover and recycle refrigerants	tool pouch, pressure regulators, weigh scale, vacuum pump, recovery/recycle unit

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of safety procedures and precautions when recovering refrigerant	
		ability to operate refrigerant recovery equipment including weigh scales	
		ability to interpret refrigerant management instructions and local refrigerant recovery codes	
		ability to connect retrieval and storage systems	
		ability to recover and recycle refrigerants	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
59.04	Drains water.	knowledge of techniques and procedures to drain water	water hose, rubber boots
		knowledge of liquid absorbent type systems	
		knowledge of water pump, water condenser and water evaporator	
		ability to interpret charts, tables and schematics	
		ability to adjust metering devices	
		ability to isolate metering device from system	
		ability to verify open drain valves and redirect water	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
59.05	Disassembles metering devices.	knowledge of techniques and procedures to disassemble metering devices	tool pouch
		knowledge of pipe connections and fittings	
		ability to interpret manufacturers' specifications, diagrams and instructions	
		ability to identify defective components	
		ability to maintain sequential order when disassembling components	
		ability to remove metering device from system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

59.06	Inspects mechanical components.	knowledge of types of mechanical components	tool pouch, alignment tools
		knowledge of testing procedures	
		ability to interpret manufacturers' specifications, drawings and schematics	
		ability to identify worn, corroded, loose or malfunctioning components	
		ability to check alignment of components	
		ability to make minor adjustments to mechanical components	
		ability to disassemble component(s) in sequential order for inspection	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to lubricate components	
		ability to assess system operation	
		ability to confirm assembly and set up	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

59.07	Inspects electrical components.	knowledge of types of electrical components	tool pouch, multimeter, ammeter, pressure gauge
		knowledge of testing procedures	
		knowledge of electric, electronic and pneumatic controls	
		ability to interpret electric wiring diagrams and schematics	
		ability to disconnect and replace duct work	
		ability to detect defective components	
		ability to identify contact wear, damage and pitting of relays and contactors	
		ability to check electrical motors, starting switch and insulation breakdown	
		ability to operate electrical test equipment	
		ability to test valve operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
59.08	Selects replacement components.	knowledge of fundamentals of operation and design of metering devices knowledge of types of metering device components knowledge of manufacturers' replacement components knowledge of electrical and installation codes knowledge of equipment capabilities ability to interpret manufacturers' specification, diagrams and instructions to assist in the identification of parts and components ability to identify system/ component information such as manufacturer, model number, serial number, size, capacity, voltage, phase and quantity ability to determine if components repair is feasible as compared to component/system replacement	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
59.09	Repairs defective components.	knowledge of techniques and procedures to repair metering devices knowledge of types, sizes and capacities of components ability to identify devices and components and determine fundamentals of operation of each	tool pouch, thermometer, pressure gauge, multimeter, torque wrench

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret manufacturers' specifications, diagrams and instructions for component repair ability to measure superheat ability to torque bolts ability to adjust component for application ability to test component and verify operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

59.10	Replaces defective components.	knowledge of techniques and procedures to replace components knowledge of system and application in which components exist knowledge of types and sizes of metering device components and their operation knowledge of rigging and hoisting techniques and procedures knowledge of welding techniques and procedures knowledge of power voltages, amperages, phase requirements ability to interpret manufacturers' specifications, blueprints, schematics and charts ability to identify and select replacement components	tool pouch, torch kit, alignment tools, multimeter, ammeter, manifold pressure gauge, thermometer, psychrometer, rigging equipment, hoisting equipment

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to adjust component for designed operation ability to test components and confirm operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
59.11	Reassembles metering devices.	knowledge of techniques and procedures to assemble metering devices knowledge of manufacturers' operating conditions knowledge of rigging and hoisting ability to interpret manufacturers' specifications, diagrams, procedures and adjustment operations ability to reassemble components in systematic order ability to align, attach and secure components ability to select components for reassembly ability to select and operate tools and equipment ability to mount, align and level metering devices ability to verify operation of metering devices	tool pouch, alignment tools, multimeter, ammeter, rigging equipment, level, hoisting equipment

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
59.12	Performs leak test on system.	knowledge of leak test methods and safety precautions knowledge of types of refrigerants knowledge of manufacturers' specifications and guidelines ability to select and operate leak detecting equipment ability to interpret test results ability to determine source of leaks	tool pouch, manifold pressure gauge, thermometer, leak detectors

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 60 Installs metering devices.

Trend: Towards the increased use of improved electronic controls.

	Sub-tasks	Enabling Objectives	Tools & Equipment
60.01	Removes packaging.	knowledge of techniques and procedures for handling metering devices knowledge of documentation, such as packing slip and invoice ability to interpret manufacturers' specifications, diagrams and instructions regarding the location and removal of shipping materials ability to unload material and/or equipment at assigned location	tool pouch, crow bar, utility knife

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to identify and report damages and/or shortages ability to dispose of waste materials	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
60.02	Verifies metering device specifications.	knowledge of types of metering devices such as capillary tube, automatic expansion valve, thermostatic expansion valve, hand operated expansion valve, low/high pressure float valve, pitot operated thermostatic expansion valve and orifice devices knowledge of job site load requirements knowledge of electrical ratings, amperages, voltages knowledge of pipe sizes ability to identify and report damages and/or shortages ability to confirm that specifications meet design and installation practices ability to confirm equipment and materials have been ordered ability to confirm system and equipment corresponds to specified materials on site such as size, capacity, voltage, phase, pressures, fuels, safety certification, standards and codes	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
60.03	Mounts metering devices.	knowledge of techniques and procedures to mount metering devices knowledge of types and sizes of metering devices knowledge of layout, location of system, space and clearance requirements knowledge of piping layout, type and size of fittings and installation codes knowledge of operation of refrigerant controls such as hand expansion valves, low/high side floats, capillary tube, automatic expansion valve and orifice device ability to recognize effect of varying load on metering devices	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
60.04	Aligns metering devices.	knowledge of types of metering devices and their components knowledge of adjusting and aligning techniques and procedures ability to mount and align device ability to recognize effect of varying load on metering devices	tool pouch, levels, alignment tools

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
60.05	Levels metering devices.	knowledge of levelling techniques and procedures	tool pouch, levels

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to operate levelling device ability to interpret manufacturers' specifications, diagrams and instructions in regards to levelling of device ability to adjust metering device level	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
60.06	Hooks up electric motor or power supply.	knowledge of techniques and procedures to hook up electric motors or power supply knowledge of power, voltage and phase requirements knowledge of required isolation device for power utilities ability to conform to labelling requirements for power utilities ability to interpret manufacturers' specifications, diagrams and instructions ability to test for voltage, phase and overload protection and rotation	tool pouch, multimeter, voltmeter, ammeter, phase meter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
60.07	Connects piping/tubing such as refrigerant and external equalizing lines.	knowledge of space requirements, mounting methods, metering device selection, accessibility, duct layout, piping/tubing layout and installation codes	tube cutters, pressure gauge, reamers, bending tools, pipe threaders, torch kit, sand cloth, flaring tools

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types and sizes of piping/tubing including attachments and fasteners	
		knowledge of piping/tubing methods and sizing techniques	
		knowledge of flaring, brazing and welding techniques and procedures	
		ability to interpret blueprints and specifications	
		ability to estimate type and amount of piping/tubing	
		ability to make pipe/tubing and drain connections	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

60.08	Checks piping/tubing connections including couplings and fittings.	knowledge of types and sizes of connections, couplings and fittings	tool pouch
		knowledge of techniques and procedures for connecting piping/tubing	
		knowledge of piping diagrams including codes and symbols	
		ability to interpret blueprints, diagrams, schematics and specifications	
		ability to recognize abnormal system operation due to under-sized or oversized piping/tubing, oil return problems and/or loss of sub-cooling	
		ability to identify loose couplings and fittings	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to adjust connections	
		ability to identify replacement needs	
		ability to seal connections	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
60.09	Evacuates non-condensible from system.	knowledge of manufacturers' procedures to evacuate non-condensibles from system	tool pouch, vacuum pump, pressure gauge, compound gauge, micron gauge, manometer
		knowledge of safety procedures when evacuating system	
		knowledge of required vacuum readings and durations	
		knowledge of effects of temperature, electrical connections/power interruptions and line sizing on evacuation	
		ability to interpret vacuum gauges to ensure evacuation and absence of any leaks and moisture	
		ability to replace vacuum pump oil	
		ability to set up and operate pressure gauges, micron gauges and vacuum pumps	
		ability to remove non-condensibles from system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
60.10	Performs leak test on devices.	knowledge of leak test methods and safety precautions knowledge of types of refrigerants knowledge of manufacturers' specifications and guidelines ability to select and operate leak detecting equipment ability to interpret test results ability to determine source of leaks	manifold pressure gauge, thermometer, halide torch kit, electronic leak detection equipment

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 61 **Diagnoses control system malfunctions.**

Trend: No apparent change.

	Sub-tasks	Enabling Objectives	Tools & Equipment
61.01	Inspects control systems visually and audibly.	knowledge of purpose and functions of electrical, electronic and pneumatic refrigeration and air conditioning controls and control circuitry knowledge of purpose and function of primary, secondary and safety control devices such as electrical control, low, high and dual pressure controls, oil failure controls, pneumatic controls, thermostats, humidistats, solenoids, magnetic starters, modulating controls/ dampers, solid state devices, magnetic starters and relays, remote	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		sensors, reverse and direct acting controls	
		knowledge of categories and types of automatic controls and control systems such as controls governing condition of space, controls functioning as protective devices and producing economy of operation such as programmable controllers and computer-based systems	
		knowledge of types of flow regulators and fundamentals of operation such as two-position control, variable volume controls, throttling dampers, splitter dampers, proportional mixing controls, face and by-pass dampers and three-way valves	
		knowledge of job site load requirements	
		ability to interpret manufacturers' specifications	
		ability to identify types of automatic control devices	
		ability to check control systems for wear, damage and malfunctioning parts	
		ability to identify and report damages and/or shortages	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
61.02	Interprets operating manuals, drawings and data.	knowledge of types of drawings such as architectural, structural and mechanical	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of conventional symbols used on drawings	
		knowledge of types of dampers and diffusers, valves, actuators and variable air vent (VAV) boxes	
		knowledge of company policies, standards and operating manuals	
		knowledge of control system software and control sequence of events	
		ability to interpret a set of working drawings including roof and floor plans, sections at curb, equipment positioning and layout of duct and piping system	
		ability to interpret data pertaining to refrigeration and air conditioning control systems	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

61.03	Runs on-board diagnostics.	knowledge of diagnostic techniques, procedures and testing devices	computer terminal, printer, simulators
		knowledge of types of control systems and their functions	
		knowledge of troubleshooting methods for control systems	
		knowledge of operation of on-board diagnostic control devices such as touch pad and control panel	
		ability to interpret original equipment and manufacturers' literature	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret information such as software and input status, wiring continuity and system failure	
		ability to identify and interpret fault codes	
		ability to interpret electrical wiring diagrams and schematics	
		ability to visually and physically check system and components to confirm fault code origination	
		ability to operate specialized troubleshooting instruments such as computer, key pad and printer	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

61.04	Checks electrical functions and output.	knowledge of operating procedures for electric/electronic control systems	tool pouch, voltmeter, multimeter, ammeter, pressure gauge, computer terminal, simulators
		knowledge of categories and types of controls and control systems such as controls governing condition of space and controls functioning as protective devices	
		knowledge of electric, electronic, pneumatic, automatic and manual valves	
		ability to interpret electrical diagrams, schematics, fault trees and manufacturers' recommended service manuals	
		ability to interpret diagnostic charts and control system diagrams	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to simulate changing temperatures and pressures and monitor control action ability to check operation of system controls in a sequential manner to assure designed operation ability to check for loose, worn or frayed electrical connections ability to check electric motors and test electrical components ability to check and calibrate electric, electronic and pneumatic controls ability to interpret test results	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

61.05	Tests system control operation, including calibration.	knowledge of techniques and procedures to test and adjust control systems such as pneumatic, electrical and electronic knowledge of types of control systems, intended application and layout knowledge of purpose and design functions of system controls ability to select and operate tools and test instruments ability to test and adjust pneumatic, electrical and electronic controls to maintain operating conditions ability to identify source of malfunction or problem	tool pouch, manometer, velometer, electronic balancing tools, ammeter, thermometer, psychrometer, computer terminal, multimeter, simulators

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to check and calibrate electric, electronic and pneumatic controls ability to re-configure control system software ability to operate testing and measuring equipment	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
61.06	Determines cause of failure.	knowledge of types of control systems and potential malfunctions knowledge of manufacturers' specifications and operating procedures ability to identify worn, misaligned, corroded and malfunctioning components ability to interpret graphs, charts, schematics and tables ability to operate testing and measuring equipment ability to test electrical components and isolate problem to specific area/ component ability to report cause of failure ability to observe loose connections and fittings ability to interpret diagnostic test procedures	tool pouch, voltmeter, pressure gauge, multimeter, computer terminal, simulator

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
61.07	Determines repair requirements.	knowledge of manufacturers' specifications knowledge of work to be performed, length of repair and time required knowledge of area of control system to be repaired such as electrical components, starters, control devices, thermostats and humidistats knowledge of cost of system components and part availability knowledge of warranty coverage ability to determine if components should be repaired or replaced ability to interpret diagnostic test procedures ability to isolate problem to specific area ability to prepare an estimate including list of parts, cost of repair and time required for repair	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
61.08	Determines warranty status.	knowledge of service and system warranty limits such as time, and degree of reimbursement knowledge of company policies regarding warranty of control systems and service and use of used accessories/parts knowledge of general periods of warranty for parts, components and systems	

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of extended or specific warranties that apply to control systems or individual components of system	
	ability to locate and identify accessory, component and system information such as model number, serial number, manufacturer, voltage, phase, size, quantity and capacity	
	ability to provide reason for part failure or request for warranty such as incorrect size, defective part or broken connections	
	ability to obtain original invoices and work orders to identify installation date, supplier, manufacturer and terms of warranty	
	ability to discuss system with owner and original equipment supplier	
	ability to contact manufacturer for warranty status requirements such as part return information and warranty cards	
	ability to obtain and complete warranty card(s)	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 62 **Repairs control systems.**

Trend: Towards compliance of government regulations regarding the handling and recovery of refrigerants.

	Sub-tasks	Enabling Objectives	Tools & Equipment
62.01	Shuts down system.	knowledge of techniques and procedures to shut down and lock out control systems including sequence knowledge of types of control systems such as electronic, electrical and pneumatic knowledge of manufacturers' specifications ability to interpret prints, charts, schematics and tables ability to identify control systems and devices ability to determine fundamentals of operation of each ability to ensure electrical and energy sources are isolated	tool pouch, multimeter, padlock

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

62.02	Isolates system.	knowledge of electronic, electric and pneumatic, automatic and manual valves knowledge of techniques and procedures to isolate control systems knowledge of shut down and start up procedures knowledge of control system components ability to interpret schematics, charts and tables	tool pouch, padlock, pressure gauge, multimeter, ammeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to recognize normal and abnormal operation of control systems	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
62.03	Recovers refrigerant.	knowledge of types of refrigerants and their composition knowledge of techniques and procedures to recover and recycle refrigerants knowledge of safety procedures and precautions when recovering refrigerant ability to operate refrigerant recovery equipment including weigh scales ability to interpret refrigerant management instructions ability to connect recovery/recycle unit	tool pouch, hoses, weigh scales, regulators, recovery/recycle unit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
62.04	Disassembles unit.	knowledge of techniques and procedures to disassemble unit knowledge of types of control systems and components of each knowledge of manufacturers' specifications knowledge of pipe connections and fittings	tool pouch, electric hammer, electric saw, ammeter, voltmeter, ohmmeter, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to maintain sequential order when disassembling air handling system components ability to identify defective components ability to adjust controls/devices ability to mark components in order to reassemble in sequence	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
62.05	Inspects electrical components.	knowledge of electric, electronic and pneumatic controls ability to interpret blueprints, specifications and electrical codes and symbols ability to locate and identify malfunctions such as contact wear, loose connections and pitting of relays and contactors ability to assess electric wiring and controls and ensure electrical and energy sources are isolated ability to check electrical motors for bearing wear, standby switches and insulation ability to test ignition transformers and solenoid valves	tool pouch, multimeter, ohmmeter, ammeter, alignment tools, pressure gauge, flame cell testers, thermocouple tester

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
62.06	Inspects mechanical components.	knowledge of types of control systems knowledge of principles of operation and parameters of performance of control systems knowledge of manufacturers' specifications ability to identify damage to mechanical components such as vibration, fouling, foreign objects, excessive heat, corrosion, uncovered parts and misalignment ability to disassemble components for inspection ability to isolate source of problem/malfunction ability to check alignment of components and make adjustments ability to recognize abnormalities and assess system operation ability to clean and lubricate components	tool pouch, vacuum cleaner, alignment tools

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
62.07	Repairs system control components.	knowledge of techniques and procedures to repair system control components knowledge of types and sizes of system components knowledge of electrical and installation codes	tool pouch, multimeter, ammeter, pressure gauge, psychrometer, calibration equipment, simulator, leak detector

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret manufacturers' specifications ability to disassemble system in sequential order ability to adjust component for application ability to verify that repaired component is operable ability to select and operate calibration equipment ability to calibrate controls ability to check intake tubes for damage, cracks, leaks and missing or inoperative components ability to replace fastening devices ability to lubricate components ability to clean, flush and drain valves and check for designed operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
62.08	Replaces system control components.	knowledge of techniques and procedures to replace system control components knowledge of electrical and installation codes knowledge of system and application in which component exists knowledge of types and sizes of valves	tool pouch, alignment tools, multimeter, ammeter, pressure gauge, psychrometer, simulator

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret manufacturers' specifications, diagrams and instructions	
		ability to select components to meet system requirements	
		ability to repack valves after repair	
		ability to lubricate components	
		ability to select and operate tools	
		ability to verify operation of replaced component	
		ability to adjust component for designed operation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

62.09	Adjusts system controls.	knowledge of existing system and its intended application in regard to designed system controls	tool pouch, psychrometer, thermometer, ammeter, multimeter, simulator
		knowledge of types of system controls	
		knowledge of test equipment and procedures	
		ability to interpret electrical wiring diagrams and schematics	
		ability to select and operate test equipment	
		ability to confirm calibration of system controls and sensors	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
62.10	Calibrates system controls.	knowledge of techniques and procedures to calibrate system controls knowledge of types of system controls, intended application and layout knowledge of purpose and design functions of system controls ability to identify source of malfunction/problem ability to select and operate tools and test instruments ability to test and adjust pneumatic, electrical and electronic controls to maintain operating conditions ability to calibrate electric, electronic and pneumatic controls ability to re-configure control system software ability to test system control(s) after calibration	tool pouch, manometer, velometer, electronic balancing tools, ammeter, thermometer, psychrometer, computer terminal, simulator, multimeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

62.11	Reassembles system unit.	knowledge of techniques and procedures to assemble system unit knowledge of operation of system controls knowledge of types and sizes of components and their function knowledge of electrical and installation codes	tool pouch, power drills, alignment tools, grease gun

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret manufacturers' specification, procedures and adjustment operations ability to connect components and make required adjustments ability to clean, flush, drain, repack and lubricate valves ability to align, attach and secure components to system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
62.12	Performs leak test on control systems.	knowledge of leak test methods and safety precautions knowledge of types of refrigerants knowledge of manufacturers' specifications and guidelines ability to select and operate leak detecting equipment ability to interpret test results ability to determine source of leaks	manifold pressure gauge, thermometer, leak detector

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
62.13	Evacuates system controls.	knowledge of manufacturers' recommendations, techniques and procedures to evacuate system controls knowledge of safety procedures when evacuating system	tool pouch, vacuum pump, vacuum gauge, compound gauge, micron gauge, manometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of effects of temperature and line sizing on evacuation ability to set up and operate equipment such as vacuum pump, gauges and leak detection equipment ability to verify evacuation of system controls	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
62.14	Recharges system controls.	knowledge of types of refrigerants such as ammonia, HFC, CFC and HCFC knowledge of types, grades and applications of oil knowledge of types of system controls knowledge of techniques and procedures to charge system knowledge of charging equipment such as graduated cylinder, weigh scale, thermometer and pressure gauge ability to replenish refrigerants and refrigerant oils in primary and secondary applications ability to set up, calibrate and operate charging equipment ability to confirm the charge ability to interpret pressure temperature charts	tool pouch, graduated cylinder, pressure gauge, thermometer, weigh scale, oil pump, circulating pump, hydrometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to label system with refrigerant details	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 63 **Installs control systems.**

Trend: Towards the increased use of energy efficient control systems.

	Sub-tasks	Enabling Objectives	Tools & Equipment
63.01	Removes shipping material.	knowledge of techniques and procedures for handling control systems ability to interpret manufacturers' specifications, diagrams and instructions regarding the location and removal of shipping materials ability to unload material and/or equipment at assigned location ability to identify and report damages and/or shortages ability to dispose of waste materials such as wood crating, wires, bolts and paper	tool pouch, crow bar, utility knife

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	NV

63.02	Verifies system control specifications.	knowledge of types of control system(s) and components	

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of energy sources such as electrical, electronic and pneumatic knowledge of job site load requirements ability to interpret system specifications, diagrams, charts and schematics ability to identify and report damages and/or shortages ability to confirm system and equipment corresponds to specified materials on site such as size, capacity, voltage, phase, pressures, fuels, safety certification, standards and codes	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	NV

Sub-tasks	Enabling Objectives	Tools & Equipment
63.03 Assembles system controls.	knowledge of techniques and procedures to assemble system controls knowledge of types of control systems such as pneumatic, electrical and electronic or combination knowledge of manufacturers' specifications and handling procedures for controls knowledge of site layout and system design ability to construct system controls in sequential order	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
63.04	Positions system controls by rigging and hoisting.	knowledge of techniques and procedures to position system controls knowledge of types and sizes of system controls knowledge of site location, layout and design of system knowledge of safe rigging and hoisting procedures ability to interpret manufacturers' specifications, diagrams, charts and schematics ability to communicate visually using standard approved hand signals for hoisting and rigging	tool pouch, hoisting equipment, rigging equipment

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	NV

63.05	Mounts system controls.	knowledge of types, sizes and capacities of controls knowledge of techniques and procedures to mount controls knowledge of layout, location of system and space requirements knowledge of wiring design and piping layout knowledge of installation codes ability to identify and select controls according to manufacturers' specifications, application diagrams, plans and shop drawings	tool pouch, electric drill, alignment tools, level

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to position controls and valves in accessible location ability to align and level controls	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	NV

63.06	Wires system controls.	knowledge of wiring techniques and procedures knowledge of types, sizes and colour coding of wires knowledge of location of system controls knowledge of electrical testing equipment such as ammeter, voltmeter, multimeter, ohmmeter and megger knowledge of power, voltage, phase requirements and electrical codes knowledge of required isolation device for power utilities ability to interpret manufactures' specifications, diagrams and instructions ability to assess amount of wire required to meet connection requirements ability to select wiring to match system specifications ability to measure and cut wires to size	tool pouch, multimeter, ammeter, phase meter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to test for voltage, phase and overload protection and rotation	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
63.07	Pipes system controls.	knowledge of types and sizes of pipes/tubing and fittings knowledge of techniques and procedures to connect piping/tubing knowledge of system layout and design knowledge of brazing and welding techniques and procedures ability to interpret blueprints, schematics, graphs and charts ability to connect pipes/tubing and fittings	tool pouch, tube cutters, reamers, bending tools, pipe threaders, torch kit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
63.08	Performs leak test on controls and/or system.	knowledge of leak test methods and safety precautions knowledge of types of refrigerants knowledge of manufacturers' specifications and guidelines ability to select and operate leak detecting equipment ability to interpret test results	manifold pressure gauge, thermometer, leak detector

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to determine source of leaks	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
63.09	Evacuates system.	knowledge of manufacturers' recommendations, techniques and procedures to evacuate control systems knowledge of safety procedures when evacuating systems knowledge of effects of temperature and line sizing on evacuation ability to set up and operate equipment such as vacuum pump and manifold pressure gauge ability to verify evacuation of system	tool pouch, vacuum pump, vacuum gauge, micron gauge, manometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
63.10	Certifies control and/or system.	knowledge of types of control systems knowledge of site design and specifications knowledge of use of testing equipment such as simulators, air monitoring equipment, temperature, pressure recorders and vibration analysis equipment knowledge of control system software knowledge of government regulations and industry standards	thermometer, pressure gauge, vibration analysis equipment, hydrometer, hygrometer, computer terminal , simulator

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to interpret manufacturers' specifications	
	ability to meet guidelines for certification as indicated by government regulations or industry standards	
	ability to confirm operation of control system(s)	
	ability to interpret and adjust control system software	
	ability to operate testing equipment and record test results	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	no	yes	yes	no	no	yes	no	NV

BLOCK G PACKAGED AND SPLIT SYSTEMS

Task 64 Installs packaged systems for heating, refrigeration, air conditioning, heat pumps and dehumidification.

Trend: Towards more energy efficient packaged systems and greater use of multiple electronic controls.

Sub-tasks		Enabling Objectives	Tools & Equipment
64.01	Obtains permits.	knowledge of municipal permits, regulations and by-laws	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types of packages and split systems knowledge of contact sources	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
64.02	Removes shipping materials.	knowledge of techniques and procedures for safe handling of packaged and split systems knowledge of rigging and hoisting techniques and procedures ability to interpret manufacturers' specifications, diagrams and instructions regarding the location and removal of shipping materials ability to match system with purchase order and packing slip ability to identify and report damages and/or shortages ability to dispose of waste materials	tool pouch, crow bar, utility knife, rigging equipment, hoisting equipment

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
64.03	Verifies system specifications.	knowledge of types of packages, split systems and their assemblies knowledge of job site load requirements knowledge of electrical ratings, amperages, voltages ability to interpret prints, schematics, graphs, charts and tables	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to identify and report damages and/or shortages	
		ability to confirm specifications meet design and installation practices	
		ability to confirm equipment and materials have been ordered	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
64.04	Positions system(s) by rigging/hoisting.	knowledge of techniques and procedures to position packaged or split systems	tool pouch, hoisting equipment, rigging equipment, level
		knowledge of types, sizes and capacities of systems such as heating, refrigeration, air conditioning, heat pumps and dehumidification	
		knowledge of site location, layout and design of system	
		knowledge of safe rigging and hoisting procedures	
		ability to interpret manufacturers' specifications, diagrams, charts and schematics	
		ability to communicate visually using standard approved hand signals for hoisting and rigging	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
64.05	Connects utilities.	knowledge of techniques and procedures to install utilities	tool pouch, ammeter, voltmeter, tube benders, pipe threaders, flaring tools, swaging tools,

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types of utilities such as gas, water, steam heat, oil and propane	level, torch kit, multimeter
		knowledge of power, voltage and phase requirements	
		knowledge of municipality permits, regulations and contact person	
		knowledge of code requirements and operating specifications for utilities	
		knowledge of filtration devices required for utilities	
		knowledge of conditioning equipment, isolating devices, labelling and testing procedures for utilities	
		ability to interpret blueprints, specifications and electrical codes and symbols	
		ability to braze, solder and weld	
		ability to attach utilities to hardware and piping	
		ability to verify connections according to company standards and regulations	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	NV

64.06	Connects air distribution system(s).	knowledge of techniques and procedures to connect air distribution system(s)	tool pouch, electric drill, saw, pipe cutters, pipe threader, utility knife, screw gun, alignment tools, torch kit
		knowledge of air distribution system components such as blower fan assembly, duct system, registers,	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		grilles, dampers, diffusers, humidifier, dehumidifier assemblies, air cleaning assemblies, exhaust hoods, mixing chamber, heating and cooling coils and controls ability to interpret manufacturers' specifications and instructions on air distribution systems ability to determine size of duct system for air distribution system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	no	yes	no	NV

64.07	Installs exchange medium piping/tubing system(s).	knowledge of system specifications, system layout and access locations knowledge of techniques and procedures to connect piping/tubing knowledge of types and sizes of piping/tubing, couplings and fittings ability to interpret blueprints, schematics, graphs and charts ability to attach couplings and fittings	tool pouch, tube cutters, tube reamers, pressure gauge, swaging tools, flaring tools, bending tools, pipe threaders, torch kit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

64.08	Mounts operating controls and safety devices.	knowledge of types, sizes and capacities of controls and valves knowledge of techniques and procedures to mount controls and valves	tool pouch, power drill, flaring tools, tube cutters, torch kit

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of layout, location of system and space requirements for mounting of controls and valves knowledge of manufacturers' specifications, suggested layout, blueprints and shop drawings ability to position controls and valves in accessible location ability to secure controls and valves ability to operate oxy-acetylene, turbo and propane torch kit ability to braze, solder and weld	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

64.09	Wires operating controls and safety devices.	knowledge of wiring techniques and procedures knowledge of types, sizes and colour coding of wires knowledge of location of controls and safety devices knowledge of electrical testing equipment such as ammeter, voltmeters, multimeter, ohmmeter and megger ability to set up, calibrate, operate and test instruments ability to interpret manufacturers' specifications, wiring diagrams and schematics ability to select amount of wire required to meet connection	tool pouch, crimpers, ammeter, voltmeters, multimeter, ohmmeter, megger

	Sub-tasks	Enabling Objectives	Tools & Equipment
		requirements and system specifications ability to measure and cut wires to size	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
64.10	Connects chilled water lines.	knowledge of system specifications, installation codes, duct and piping layout and access locations knowledge of techniques and procedures to connect water lines knowledge of piping methods and sizing techniques knowledge of types and sizes of piping, couplings and fittings knowledge of soldering and threading techniques and procedures ability to interpret blueprints, diagrams, drawings and charts ability to solder, braze and weld ability to estimate type and amount of piping ability to measure and cut types of tubing and piping ability to attach couplings and fittings	tool pouch, pipe cutters, pipe threader, torch kit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
64.11	Connects steam/hot water lines.	knowledge of techniques and procedures to connect steam/hot water lines knowledge of system specifications, installation codes, duct and piping layout and access locations knowledge of types and sizes of piping/tubing knowledge of piping methods and sizing techniques knowledge of soldering and threading techniques and procedures ability to interpret blueprints, schematics, diagrams and charts ability to estimate type and amount of piping ability to measure, cut and attach lines	tool pouch, pipe cutters, pipe threader, torch kit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	no	no	NV

64.12	Connects drain lines.	knowledge of system specifications, installation codes, duct and piping layout and access locations knowledge of techniques and procedures to connect drain lines knowledge of piping methods and sizing techniques knowledge of types and sizes of piping, couplings and fittings knowledge of soldering and threading techniques and procedures	tool pouch, pipe cutters, pipe threaders, torch kit

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret blueprints, diagrams, drawings and charts	
		ability to solder, braze and weld	
		ability to estimate type and amount of piping	
		ability to measure and cut types of tubing and piping	
		ability to make pipe and drain connections	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

Task 65 **Installs split systems for refrigeration, air conditioning, heat pumps and dehumidification.**

Trend: Towards more energy efficient systems and the use of multiple electronic controls.

	Sub-tasks	Enabling Objectives	Tools & Equipment
65.01	Obtains permits.	knowledge of municipal permits, regulations and by-laws	
		knowledge of types of packages and split systems	
		knowledge of contact sources	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	NV

65.02	Removes shipping materials.	knowledge of techniques and procedures for safe handling of split systems	tool pouch, crow bar, utility knife, rigging

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of rigging and hoisting techniques and procedures	equipment, hoisting equipment
		ability to interpret manufactures' specifications, diagrams and instructions regarding the location and removal of shipping materials	
		ability to match system with purchase order and packing slip	
		ability to identify and report damages and/or shortages	
		ability to dispose of waste materials	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

65.03	Verifies system specifications.	knowledge of types of split systems and their assemblies such as refrigeration, air conditioning, heat pumps and dehumidification	
		ability to interpret prints, schematics, graphs, charts and tables	
		knowledge of job site load requirements	
		knowledge of electrical ratings, amperages, voltages	
		ability to identify and report damages and/or shortages	
		ability to confirm specifications meet design and installation practices	
		ability to confirm equipment and materials have been ordered	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
65.04	Positions components by rigging/hoisting.	knowledge of techniques and procedures to position split systems knowledge of types, sizes and capacities of systems such as heating, refrigeration, air conditioning, heat pumps, humidification and dehumidification knowledge of site location, layout and design of system knowledge of safe rigging and hoisting procedures ability to interpret manufacturers' specifications, diagrams, charts and schematics ability to communicate visually using standard approved hand signals for hoisting and rigging	tool pouch, hoisting equipment, rigging equipment

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
65.05	Connects heat exchange medium piping system.	knowledge of techniques and procedures to connect piping/tubing knowledge of welding and brazing techniques and procedures knowledge of effects of condition changes on operating systems such as air/water flow, space, temperature, product load, humidity and superheat ability to solder, braze and weld ability to connect pipe/tubing to refrigerant lines, drain and defrost lines according to piping layout and installation instructions	tool pouch, pressure gauge, tube cutters, reamers, bending tools, flaring tools, torch kit

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to select and operate tools and test equipment	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
65.06	Connects refrigerant piping/tubing and accessories.	knowledge of techniques and procedures to connect refrigerant piping/tubing and accessories ability to interpret manufacturers' specifications, diagrams and charts ability to set up and operate connecting equipment such as welder, torches, threaders, swaging and flaring tools ability to operate test instruments ability to apply gasket, O-rings and sealants ability to apply torque to fasten bolts	tool pouch, tube cutters, tube reamers, pressure gauge, swaging tools, flaring tools, bending tools, pipe threaders, torch kit, nitrogen cylinder and regulator, torque wrench

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
65.07	Connects utilities.	knowledge of electrical and installation codes including polarity knowledge of techniques and procedures to connect utilities such as gas, water and electricity knowledge of power, voltage and phase requirements knowledge of permits and regulations	tool pouch, ammeter, voltmeter, tube benders, pipe threaders, flaring tools, swaging tools, level, torch kit, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to interpret blueprints, building layout and electrical codes and symbols ability to install fans ability to verify connections according to company standards and manufacturers' specifications	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
65.08	Connects air distribution system.	knowledge of types of air distribution systems knowledge of techniques and procedures to connect air distribution system ability to interpret manufacturers' specifications, diagrams and charts ability to determine size of duct system for air distribution ability to match split system with air distribution system ability to attach air distribution system to designed location **(NOT COMMON CORE)**	tool pouch, electric drill, saw, pipe cutters, pipe threaders, screw gun, alignment tools

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	no	no	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
65.09	Installs heat exchange medium piping system.	knowledge of system specifications, layout and access locations knowledge of techniques and procedures to install piping/tubing	tool pouch, tube cutters, tube reamers, pressure gauge, swaging tools, flaring tools, bending tools, pipe threaders,

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types and sizes of piping/tubing, couplings and fittings ability to interpret blueprints, schematics, graphs and charts ability to measure, cut and attach piping/tubing, couplings and fittings ability to solder, braze and weld	torch kit, nitrogen cylinder and regulator, welding kit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	NV

65.10	Mounts operating controls and safety devices.	knowledge of types, sizes and capacities of operating controls and safety devices knowledge of techniques and procedures to mount controls and devices knowledge of layout, location of system and space requirements knowledge of wiring design and piping layout knowledge of installation codes ability to identify and select controls according to manufacturers' specifications, application diagrams, plans and shop drawings ability to solder, braze and weld ability to position controls and valves in accessible location for operation ability to level controls	tool pouch, power saw, electric drill, pipe threaders, flaring tools, tube cutters, torch kit

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
65.11	Wires operating controls and safety devices.	knowledge of wiring techniques and procedures knowledge of types, sizes and colour coding of wires knowledge of location of controls and safety devices knowledge of electrical testing equipment such as ammeter, voltmeters, multimeter, ohmmeter and megger ability to set up, calibrate, operate and test instruments ability to interpret manufacturers' specifications, wiring diagrams and schematics ability to assess amount of wire required to meet connection requirements ability to select wiring to match system specifications ability to measure and cut wires to size	tool pouch, crimpers, ammeter, voltmeters, multimeter, ohmmeter, megger

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	NV

65.12	Connects chilled water lines.	knowledge of system specifications, installation codes, duct and piping layout and access locations knowledge of techniques and procedures to connect water lines knowledge of piping methods and sizing techniques	tool pouch, tube cutters, tube reamers, swaging tools, flaring tools, bending tools, pipe threaders, torch kit

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of types and sizes of piping, couplings and fittings knowledge of soldering and threading techniques and procedures ability to interpret blueprints, diagrams, drawings and charts ability to estimate type and amount of piping ability to measure and cut types of tubing and piping ability to solder, braze and weld ability to attach couplings and fittings	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	no	NV

65.13	Connects drain line.	knowledge of system specifications, installation codes, duct and piping layout and access locations knowledge of techniques and procedures to connect drain lines knowledge of piping methods and sizing techniques knowledge of types and sizes of piping, couplings and fittings knowledge of soldering and threading techniques and procedures ability to interpret blueprints, diagrams, drawings and charts ability to measure and cut types of tubing and piping	tool pouch, tube cutters, tube reamers, pressure gauge, swaging tools, flaring tools, bending tools, pipe threaders, torch kit

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to solder, braze and weld ability to attach couplings and fittings	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
65.14	Performs leak test on system.	knowledge of leak test methods and safety precautions knowledge of types of refrigerants knowledge of manufacturers' specifications and guidelines ability to select and operate leak detecting equipment ability to inspect gaskets and seals ability to interpret test results and determine source of leaks	manifold pressure gauge, thermometer, leak detectors

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
65.15	Evacuates systems.	knowledge of manufacturers' recommended techniques and procedures to evacuate system knowledge of effects of temperatures, electrical connects and/or power interruptions and line sizing on evacuation knowledge of safety procedures when evacuating system ability to set up and operate equipment such as micron gauge and vacuum pump	tool pouch, vacuum pump, vacuum gauge, compound gauge, micron gauge, manometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to verify evacuation of system	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

65.16	Certifies system.	knowledge of certification requirements for types of systems, components and applications ability to arrange with authorities to carry out required inspections and testing	tool pouch

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	no	yes	yes	yes	NV

BLOCK H PREPARATION OF CONSTRUCTION FOR REFRIGERATION AND AIR CONDITIONING SPACE

Task 66 Constructs walk-in boxes.

Trend: Towards the increased use of prefabricated panels for the construction of walk-in boxes. Towards the use of glass display doors in order to exhibit merchandise product.

	Sub-tasks	Enabling Objectives	Tools & Equipment
66.01	Removes shipping materials.	knowledge of techniques and procedures for handling walk-in box assemblies such as glass and prefabricated panel sections	tool pouch, utility knife, crow bar, hoisting equipment, rigging equipment

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of rigging and hoisting techniques and procedures	
	ability to interpret manufacturers' specifications, diagrams and instructions regarding the location and removal of shipping materials	
	ability to uncrate material and/or equipment at assigned location	
	ability to operate fork lift	
	ability to identify and report damages and/or shortages	
	ability to dispose of waste material	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Sub-tasks	Enabling Objectives	Tools & Equipment
66.02 Verifies walk-in boxes.	knowledge of types of walk-in boxes, components and accessories	
	knowledge of job site layout, voltage and load requirements	
	knowledge of manufacturers' specifications	
	ability to interpret system specifications and compare with unit nameplate	
	ability to match walk-in box assembly with packing slip and purchase order	
	ability to identify and report damages and/or shortages	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
66.03	Interprets drawings.	knowledge of manufacturers' specifications, diagrams, charts, tables and drawings knowledge of electrical symbols, codes, drawings and blueprint layout ability to interpret blueprints for drain access locations ability to determine dimensions and tolerances ability to visualize in three dimensions ability to assess piping, duct and wiring layouts	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

66.04	Erects walk-in boxes.	knowledge of techniques and procedures to construct walk-in boxes knowledge of safe handling techniques for equipment such as glass doors and components knowledge of system specifications such as structural and space requirements and assembling techniques knowledge of lifting and hoisting techniques and procedures knowledge of mounting, levelling and aligning procedures knowledge of wiring and piping techniques and procedures	tool pouch, dolly, jack, scaffolding, band saw, electric drill, electric hammer, hoisting equipment, rigging equipment, level, alignment tools

	Sub-tasks	Enabling Objectives	Tools & Equipment
		knowledge of techniques and procedures to hook up ducts and drains	
		ability to interpret drawings, blueprints and manufacturers' and system specifications	
		ability to position, align and secure walk-in boxes	
		ability to select and operate tools and equipment	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
66.05	Installs doors and accessories.	knowledge of techniques and procedures to install doors and accessories	tool pouch, electric drill, rules, square, utility knife, levels
		knowledge of types and sizes of accessories such as handles, latches, air/strip curtains, lights, fixtures, switches, locks and trim	
		knowledge of the purpose of air and strip curtains	
		knowledge of levelling and shimming procedures	
		ability to position, align and fasten doors and accessories such as door handles, latches, lights, anti-sweat heaters, air curtains and air strips	
		ability to install drain line heaters on freezers	
		ability to assemble air curtains in relation to air transfers	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to make adjustments to doors and accessories	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

66.06	Installs vacuum break.	knowledge of techniques and procedures to install vacuum breaks knowledge of designed pressures and temperatures ability to interpret manufacturers' specifications, drawings, diagrams and charts ability to assess climate conditions and identify installation techniques and procedures to be followed ability to align, measure and cut hole(s) for vents ability to position and attach vent	tool pouch, electric saw, electric drill, alignment tool, tape measure

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

66.07	Installs shelving and racking.	knowledge of techniques and procedures to install shelving and racking knowledge of system specifications, layout and space requirements knowledge of types, sizes and capacities of shelving and racking ability to interpret drawings, tables, diagrams and charts	tool pouch, electric drill, electric saw, level, alignment tool

Sub-tasks		Enabling Objectives	Tools & Equipment
		ability to select and operate tools and equipment	
		ability to mark, position, align and fasten wall shelving and/or racking	
		ability to make adjustments to shelving and/or racking	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	NV

66.08	Repairs floor/base.	knowledge of techniques and procedures to repair floors/base	tool pouch, electric drill, jig saw, crimpers
		knowledge of fastening devices and materials	
		knowledge of types and grades of insulation and application procedures of insulation	
		knowledge of structural characteristics of materials, such as steel, concrete, wood, glass, aluminum and metal	
		knowledge of freezer floor ventilation procedures	
		knowledge of potential health and safety hazards with materials such as lead, fibreglass, insulation, taping cement, caulking materials	
		knowledge of recycling and hazardous waste requirements	
		ability to interpret specifications, drawings and blueprints	
		ability to select and operate tools and equipment such as cutters, threaders,	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		crimpers, drills, power saws, powder-actuated stud tools and levels ability to measure, cut and install insulation material	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
66.09	Caulks joints.	knowledge of caulking techniques, procedures and compounds knowledge of areas to be caulked, such as door openings, pipes, ducts, electrical outlets and fixtures knowledge of techniques and procedures to apply caulking material knowledge of potential health and safety hazards associated with fibreglass insulation, cleaning compounds, taping cement and caulking materials ability to verify containment of temperatures and pressures ability to apply caulking and correct any irregular application	tool pouch, putty knife, stapler, utility knife, caulking gun, temperature gauge, pressure gauge

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
66.10	Installs hangers for piping.	knowledge of types of ceiling surfaces such as drywall, metal and wood knowledge of types, sizes and characteristics of fasteners and inserts	tool pouch, electric drill, electric saw, ladder, punch, tape measure

Sub-tasks	Enabling Objectives	Tools & Equipment
	knowledge of gauges/sizes of hangers and hanger application methods ability to coordinate with other trades ability to interpret blueprints, drawings and specifications and identify location of hangers ability to measure and cut hangers ability to determine and install type of insert ability to position and bend tops of hangers for inserts ability to operate power tools	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Sub-tasks	Enabling Objectives	Tools & Equipment
66.11 Installs curbs.	knowledge of techniques and procedures to install curbs knowledge of types of curb materials such as wood, concrete and metal knowledge of measuring and cutting techniques and procedures ability to interpret system specifications, blueprints and drawings ability to select and operate cutting tools ability to position, align and level curbs	tool pouch, screw gun, band saw, keyhole saw, utility knife, alignment tools, level

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
66.12	Cleans walk-in boxes and surrounding area.	knowledge of previous site condition knowledge of cleaning materials and techniques knowledge of recycling and hazardous waste requirements knowledge of refuse location(s) ability to verify that the work area is clear of all debris	broom, shovel, hazardous waste container

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

Task 67 Constructs computer rooms. (NOT COMMON CORE)

Trend: Towards the greater use of environmentally controlled systems.

	Sub-tasks	Enabling Objectives	Tools & Equipment
67.01	Removes shipping materials.	knowledge of techniques and procedures for handling materials for computer room assemblies knowledge of types and sizes of assemblies such as ceiling and floor tiles, pedestals, posts and accessories knowledge of hoisting and lifting techniques and procedures ability to interpret manufacturers' specifications, diagrams and instructions regarding the location and removal of shipping materials ability to unload material and/or equipment at assigned location	tool pouch, crow bar, utility knife

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to identify and report damages and/or shortages ability to dispose of waste materials such as crating, paper, wires, shipping bolts and staples **(NOT COMMON CORE)**	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	no	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
67.02	Verifies computer room assemblies.	knowledge of computer room specifications, layout and space requirements knowledge of manufacturers' specifications knowledge of electrical ratings, amperages, voltages ability to confirm system and equipment corresponds to specified materials on site such as size, capacity, safety certification, standards and codes ability to interpret system specifications and compare with unit nameplate ability to identify and report damages and/or shortages **(NOT COMMON CORE)**	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	yes	no	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
67.03	Lays out floor.	knowledge of techniques and	tool pouch, chalk line, square, tape measure,

	Sub-tasks	Enabling Objectives	Tools & Equipment
		procedures to layout computer room floors knowledge of room dimensions knowledge of positioning of electrical outlets and accessories in floors ability to select and operate levelling and squaring tools ability to locate and mark placement of electrical outlets and accessories ability to interpret specifications and blueprints	marker, alignment tools, water level, spirit level

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	no	no	yes	no	yes	yes	no	NV

67.04	Seals room.	knowledge of types of sealants such as taping and caulking compounds knowledge of sealant application techniques and procedures knowledge of vapour barrier application techniques and procedures knowledge of types and sizes of vapour barriers and insulation materials knowledge of manufacturers' procedures and health and safety procedures to install insulation and vapour barriers knowledge of national, provincial/territorial and/or municipal building codes related to fire resistance ratings	tool pouch, crimpers, brush, sprayers, paint roller, caulking gun

Sub-tasks	Enabling Objectives	Tools & Equipment
	ability to interpret blueprints, drawings and specifications	
	ability to recognize types of insulation such as fibreglass, styrofoam and ridged foam	
	ability to recognize types of vapour barrier such as rubberized, polyurethane, ice and water shields	
	ability to measure area and cut insulation and vapour barrier to size	
	ability to apply compound and tape to joints	
	ability to verify thorough sealant application	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	no	no	yes	no	yes	yes	no	NV

67.05 Sets up pedestal.	knowledge of techniques and procedures to install pedestal system	tool pouch, glue gun, water level, chalk line
	knowledge of types and sizes of pedestals	
	knowledge of location of electrical and mechanical equipment in area above cavity	
	ability to interpret blueprints, drawings and specifications	
	ability to position and glue pedestals	
	ability to apply fixative to pedestals	
	ability to fasten stabilizers to pedestals	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to operate levelling instruments	
		ability to measure and chalk lines	
		ability to level pedestal	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	no	no	yes	no	yes	no	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
67.06	Installs tiles.	knowledge of techniques and procedures to install tiles	tool pouch, level band saw, jig saw, tape measure, broom, shovel
		knowledge of types and characteristics of tiles and floor layout	
		knowledge of measuring and cutting techniques and procedures	
		ability to interpret blueprints, drawings and specifications	
		ability to operate types of power saws such as band saw and jig saw	
		ability to measure floor and tiles to meet system specifications	
		ability to fit tiles into place	
		ability to verify that the work area is clear of all debris	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	no	no	yes	no	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
67.07	Arranges for ramps/steps to be built.	knowledge of computer room specifications, layout and space requirements ability to contact outside trades people to construct ramps/steps ability to interpret blueprints, drawings and specifications ability to measure space requirements for ramps/steps ability to schedule work to be performed ability to inspect completion of work	

(NOT COMMON CORE)

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	no	no	no	yes	no	yes	no	no	NV

Task 68 **Installs display cases.**

Trend: Towards the use of more energy efficient systems.

	Sub-tasks	Enabling Objectives	Tools & Equipment
68.01	Unloads display cases.	knowledge of techniques and procedures for handling display cases and assemblies knowledge of lifting and hoisting techniques and procedures ability to interpret manufacturers' and system specifications	tool pouch, crow bar, utility knife, hoisting equipment, rigging equipment

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to operate lifting equipment such as fork lift ability to uncrate materials and/or equipment at assigned locations ability to remove packaging materials, such as corrugated paper, bindings, staples and wood supports ability to identify and report damages and/or shortages ability to dispose of shipping and waste materials	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

68.02	Verifies display cases.	knowledge of types of display cases, components and accessories knowledge of job site layout, load and space requirements knowledge of manufacturers' specifications knowledge of electrical ratings, amperages and voltages ability to match display cases with packing slip and purchase order	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

68.03	Interprets drawings.	knowledge of manufacturers' specifications, diagrams, charts, tables, electrical codes and symbols	

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to determine codes, symbols, dimensions and tolerances ability to interpret system specifications in order to position display case in designated area ability to visualize in three dimensions ability to determine positioning of water and power locations ability to assess piping, ducting, wiring layouts and drain access locations	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	NV

68.04	Positions display cases.	knowledge of site layout and space requirements knowledge of techniques and procedures to position display cases knowledge of lifting and hoisting techniques and procedures ability to interpret blueprints and manufacturers' specifications ability to operate lifting equipment such as fork lifts ability to place display cases in designated location	tool pouch, dolly, jacks, pry bars, level, electric drill, fork lift, hoisting equipment, rigging equipment

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
68.05	Aligns display cases.	knowledge of techniques and procedures to align display cases knowledge of lifting and hoisting techniques and procedures knowledge of levelling and shimming procedures ability to interpret system specifications, blueprints and drawings ability to operate lifting equipment such as fork lift ability to level, square and shim display cases	tool pouch, square, dolly, jacks, pry bars, level, alignment tools, fork lift, rigging equipment, hoisting equipment

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

68.06	Connects display cases.	knowledge of techniques and procedures to connect display cases knowledge of manufacturers' specifications and design features of display cases ability to join display cases together with fasteners such as bolts and clamps ability to attach and secure accessory hardware such as inserts, flashing, casings and rubber protective material	tool pouch, level, electric drill, screw gun, tape measure

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
68.07	Installs accessories.	knowledge of designed layout and product information knowledge of types of display cases and associated accessories such as latches, hinges, water sensors and rubber guards ability to interpret manufacturers' specifications, charts and diagrams ability to position, align and secure accessories ability to measure, cut and attach rubber guards	tool pouch, screw gun, electric drill, alignment tools, tape measure, utility knife

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
68.08	Hooks up wiring and plumbing to display cases.	knowledge of types and sizes of piping including attachments and fasteners knowledge of piping methods and sizing techniques knowledge of plumbing codes and practices knowledge of display case design, site layout and access locations knowledge of electrical and installation codes and symbols including polarity knowledge of power, voltage and phase requirements knowledge of permits and regulations ability to interpret system specifications, blueprints, site layout,	tool pouch, pipe cutters, pipe threaders, ammeter, voltmeter, ohmmeter, pullers, multimeter

	Sub-tasks	Enabling Objectives	Tools & Equipment
		electrical wiring diagrams, codes and symbols ability to assess amount of wire required to meet connection requirements ability to measure, cut and connect wires ability to connect water lines to display case(s) ability to hook up utilities to primary system ability to verify connections	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	no	yes	no	NV

68.09	Connects drains.	knowledge of system design, accessories and piping layout knowledge of piping and plumbing codes and practices knowledge of manufacturers' system specifications ability to interpret diagrams, drawings and piping layout ability to measure, cut and attach pipe and drain connections ability to solder, braze and weld ability to attach and secure fittings	tool pouch, tape measure, pressure gauge, swaging tools, flaring tools, bending tools, pipe threaders, torch kit, nitrogen cylinder and regulator

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
68.10	Installs shelving and racks.	knowledge of techniques and procedures to install shelving and racking knowledge of system specifications, layout and space allocation knowledge of types, sizes and capacities of shelving and racking ability to interpret drawings, tables and diagrams ability to select and operate tools and equipment ability to position, align and fasten shelving and/or racks ability to level and make adjustment to shelving and/or racking	tool pouch, electric drill, electric saw, level, alignment tool

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

68.11	Cleans cases and surrounding area.	knowledge of previous site condition knowledge of cleaning materials and techniques knowledge of recycling and hazardous waste requirements knowledge of refuse location ability to verify that the display cases and installation area is clear of debris	broom, shovel, hazardous waste containers

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
68.12	Performs operational check.	knowledge of system operating parameters and system specifications knowledge of start up procedures knowledge of system humidity, pressure and temperature requirements ability to interpret blueprints, building layout and electrical codes and symbols ability to start up system in order to achieve operational check ability to interpret test instruments such as pressure and temperature gauges ability to recognize anomalies in start up through visual and auditory inspection	tool pouch, pressure gauge, temperature gauge, multimeter, ammeter, pressure regulator, psychrometer

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
68.13	Installs humidity control system.	knowledge of system design pressures, temperatures and humidity requirements knowledge of site layout and location of installation knowledge of wiring techniques and procedures ability to interpret manufacturers' specifications, diagrams, charts and tables ability to install and attach wiring to control system	tool pouch, pressure gauge, pressure regulator, psychrometer

	Sub-tasks	Enabling Objectives	Tools & Equipment
		ability to validate operation of electric, electronic and pneumatic humidity controls	

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

	Sub-tasks	Enabling Objectives	Tools & Equipment
68.14	Starts up system.	knowledge of system operating parameters and manufacturers' specifications knowledge of start up techniques and procedures knowledge of blueprints, building layout and electrical codes and symbols knowledge of types of test instruments ability to interpret manufacturers' specifications, charts, schematics and diagrams ability to check operating temperatures, pressures and humidity ability to confirm operation is within specifications ability to recognize anomalies in start up through visual and auditory inspection	tool pouch, pressure gauge, multimeter, thermometer, ammeter

NF	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV